Smithsonian

JUNE 2000

Onstage at a new shrine to rock and roll:

Jimi Hendrix's hat, Janis Joplin's boa, Eric Clapton's guitar and Big Jay McNeely's sax

[PAGE 68]

©2000 Hewlett-Packard Company

That great plan for a business you've been saving?

It's time to let it out into the world. Because now everyone can play in the emerging e-services economy. Your rainy day idea can team up with someone else's rainy day idea, or everyone else's rainy day idea. And hp servers, storage, software and consulting will help tie them all together. Do you have a business in you?

Invent it here: www.hp.com/e-services

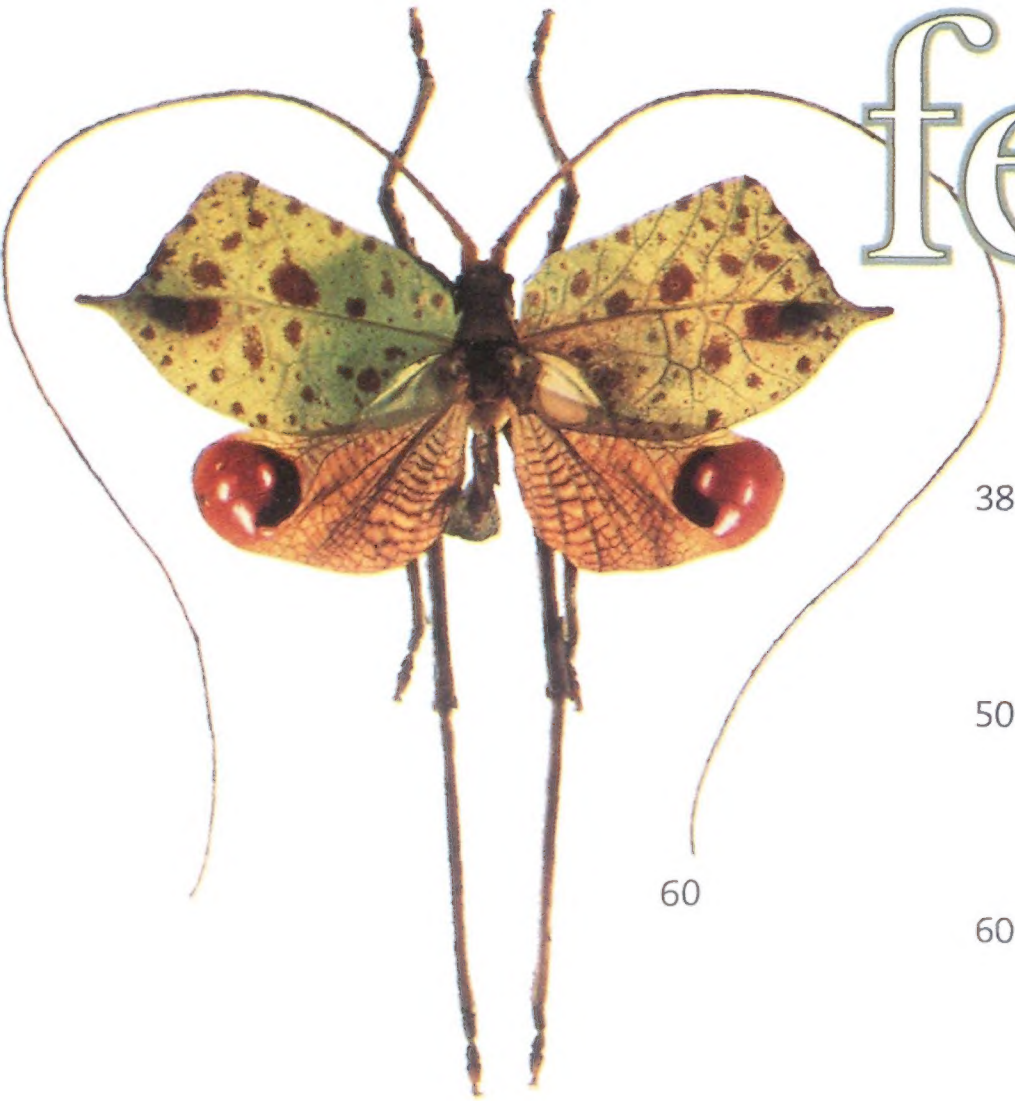
The Grand Opening of You.

e-services solutions from hp.

SMITHSONIAN

features

JUNE 2000 ♜ VOLUME 31, NUMBER 3



38 Charting the Terrain of Touch
Findings from MIT's haptics lab may lead to virtual surgery, robot hands sensitive enough to pick up pins, and more
BY RICHARD WOLKOMIR ◆ PHOTOGRAPHS BY RICHARD SCHULTZ

50 Afloat with Fly Boats and Leggers
England's canals are thriving anew as folks discover the historic charm and simple pleasures of life on these waterways
BY SUSAN HORNIK ◆ PHOTOGRAPHS BY MICHAEL FREEMAN

60 Supermodels with Six Legs
Insects, the most successful creatures on the planet, show off their go-anywhere style in a special Paris collection
PHOTOGRAPHS BY GILLES MERMET

68 A Swoopy, Funky Fun House of Rock
Opening in Seattle this month, Experience Music Project is a high-volume, hands-on celebration of musical creativity
BY RICHARD COVINGTON ◆ PHOTOGRAPHS BY STEVE GOTTLIEB

80 The Quiet Mastery of Jean-Siméon Chardin
In richly detailed, sensitive portraits of everyday scenes, the French artist "captures and holds the moment for eternity"
BY PHYLLIS TUCHMAN

90 Horning In?
Bighorn sheep have been returned to many of their old haunts over the past 20 years, but uncertainties still cloud their future
BY STEVE KEMPER

102 For the Love of Mustard
With so many new—and unusual—flavors to choose from, connoisseurs of this condiment have never had it so good
BY JOSEPH A. HARRISS ◆ PHOTOGRAPHS BY BROOKS WALKER

112 The Amazing Author of Oz
A century after its publication, L. Frank Baum's "modernized fairy tale" about Dorothy and the Wizard is still going strong
BY BRUCE WATSON

HOW MANY YEARS OF SELF-DENIAL WILL IT TAKE BEFORE YOU CRACK?

The All-New Avalon.

The most luxurious, spacious sedan we've ever created.

STARTING UNDER $26,100.* MODEL SHOWN, $26,940.

Your Fairy Godmother is nowhere to be found. Luckily, you can reward yourself with a new Avalon. It has a refined 210-horsepower V6 and a ride that stirs the senses without rattling the spine. Do you deserve this much luxury? If you have to ask, you're not ready.

TOYOTA
be good to yourself.
every day.

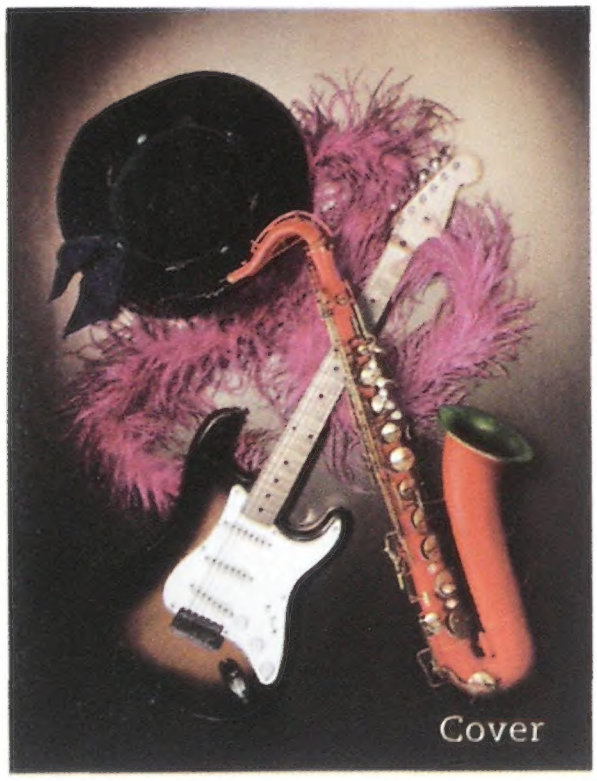
www.toyota.com ✦ 1·800·go·toyota ©1999 Toyota Motor Sales, U.S.A., Inc. Buckle Up! Do it for those who love you.

*Starting MSRP including destination charge. Excluding taxes, license, title and regionally required or other optional equipment. Actual dealer price may vary.

SMITHSONIAN

departments

JUNE 2000 ♜ VOLUME 31, NUMBER 3



Cover Pop icons: "Brownie," the Fender Stratocaster guitar on which Clapton played his anthem "Layla"; the boa worn by blues star Joplin on her *Pearl* album; Hendrix's felt hat, from *Smash Hits*; McNeely's tenor sax, which inspired the screech in rock and roll.
PHOTOGRAPH BY STEVE GOTTLIEB AND STANLEY SMITH

12 Letters to the Editor

121 Additional Sources

123 Smithsonian Study Tours

10 A Note from the Secretary
Whole Worlds to Order
BY SECRETARY LAWRENCE M. SMALL

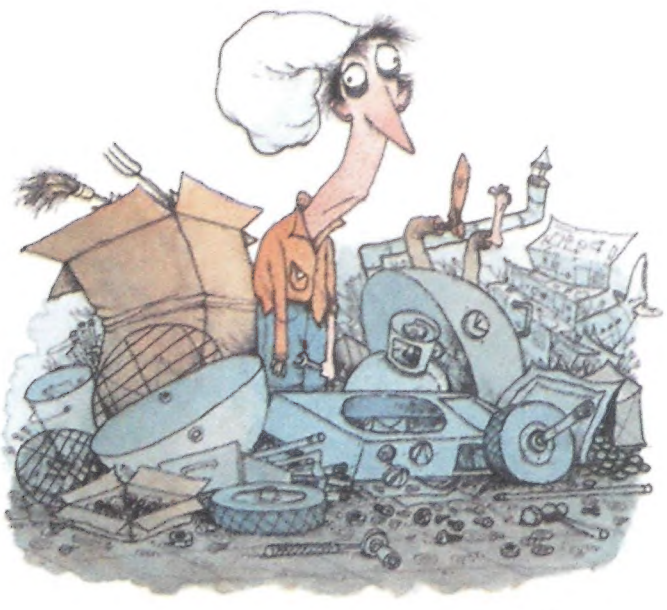
16 Points of Interest
Camping in Concert
BY MINNA MORSE

22 The Object at Hand
The "Indomitable" MRI
BY JULIE WAKEFIELD

27 Around the Mall & Beyond
The Talking Drums
BY MICHAEL KERNAN

32 Smithsonian Highlights
Art Recalls a Forgotten War
Highlights Calendar starts on page 34

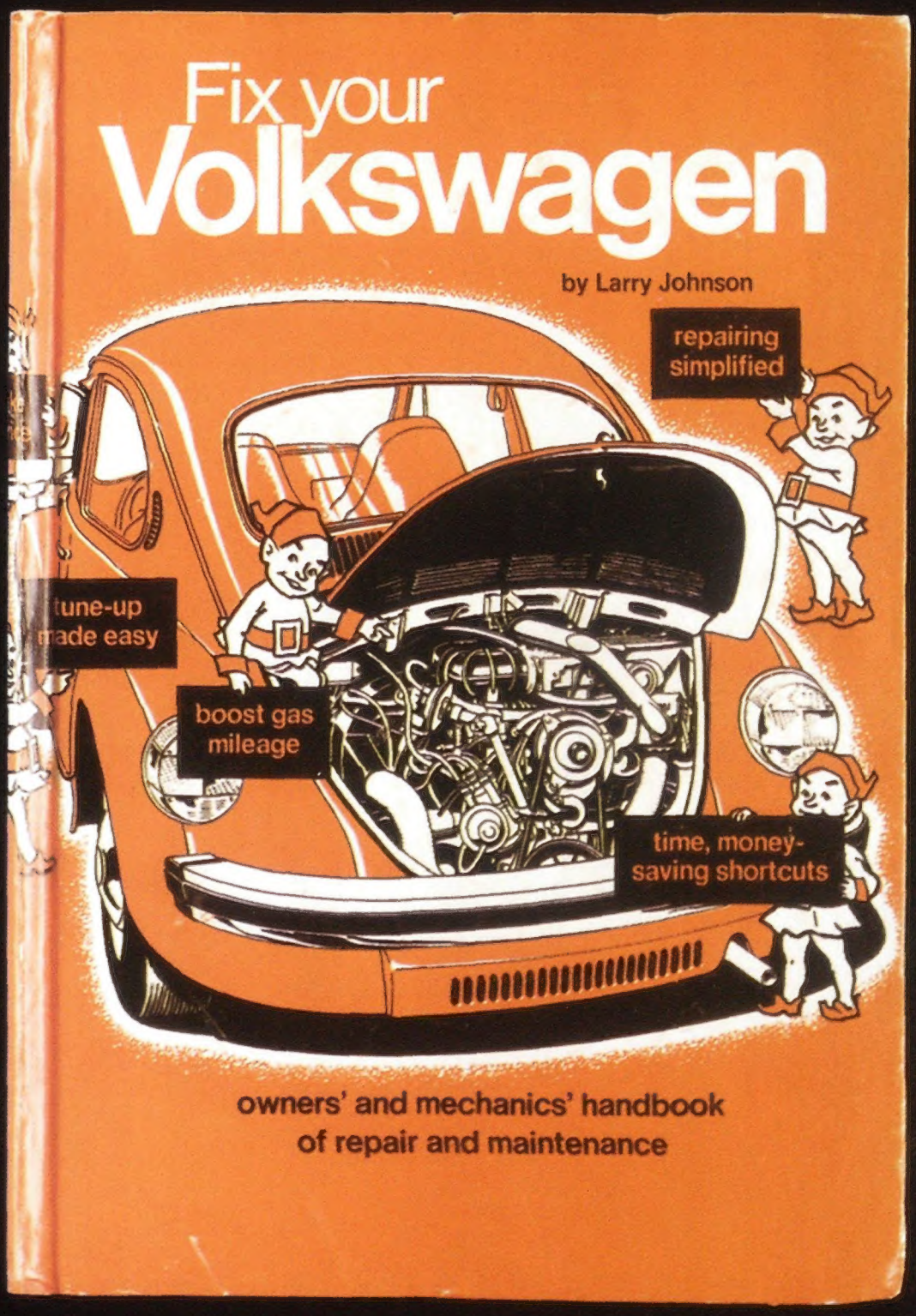
124 The Last Page
Shop for This Label: "No Assembly Required"
BY DANNY HEITMAN



124

27

June 7, 1974. Lost during long, strange trip.



April 2, 2000. Find on Alibris…whoa.

alibris

www.alibris.com

Books you thought you'd never find.

©2000 Alibris

Vintage
ANIMATION ART

© Walt Disney Studios

Collect A Memory
Create An Heirloom

© Walt Disney Studios

Great American Ink Galleries
Los Angeles ✦ Reno
800-552-BUGS
310-552-2847 CartoonGallery.com

Galapagos

EX-PE-DI-TION (ek'spi dish'ən)
n. 1a. A journey undertaken by an organized group of people with a definite objective.

Explore the world with the family that pioneered expedition travel.

Lindblad Expeditions

FOR INFORMATION ON GALAPAGOS AND OUR OTHER WORLDWIDE EXPEDITIONS, SEE YOUR TRAVEL AGENT OR CALL:

1-800-EXPEDITION
(800-397-3348)
WWW.EXPEDITIONS.COM
REFER TO: 3SM-GA040

Smithsonian

SECRETARY OF THE SMITHSONIAN INSTITUTION
Lawrence M. Small

EDITOR
Don Moser

BOARD OF EDITORS
Kathleen M. Burke
Suzanne Crawford
Jim Doherty
Alexis Doster III
Marlane A. Liddell
Sally Scott Maran
Edgar Rich, *Pictures*
John F. Ross
John P. Wiley, Jr.

ASSOCIATE EDITORS
Diane M. Bolz
Caneel Cotton, *Pictures*
Bruce Hathaway
Marian Smith Holmes
Karen Larkins
Alison C. McLean
Lucinda Moore
Beth Py-Lieberman
Ruth Ravenel
Bonnie Stutski, *Pictures*

ASSISTANT EDITORS
Elizabeth J. Erskine
Lyn Garrity
Valerie Jablow
Christian Moen
Minna Morse
Angela M. Pleasants
Sadie Quarrier, *Pictures*

RESEARCH ASSISTANTS
Karla A. Henry
Carolyn McGhee

ASSISTANT TO THE EDITOR
Rebecca Maksel

CONTRIBUTING EDITORS
Constance A. Bond
Timothy Foote
Edwards Park
Bennett Schiff
Nancy Seaman
Paul Trachtman

Smithsonian Institution

BOARD OF REGENTS

EX OFFICIO
Chief Justice of the United States, William H. Rehnquist, *Chancellor*
Vice President of the United States, Albert Gore, Jr.

APPOINTED BY THE PRESIDENT OF THE SENATE
Hon. Thad Cochran
Hon. Bill Frist
Hon. Daniel P. Moynihan

APPOINTED BY THE SPEAKER OF THE HOUSE
Hon. Sam Johnson
Hon. Robert P. Matsui
Hon. Ralph Regula

APPOINTED BY JOINT RESOLUTION OF CONGRESS
Hon. Howard H. Baker, Jr.
Hon. Barber B. Conable, Jr.
Ms. Anne d'HarnoncourtDr.
Hanna H. Gray
Dr. Manuel L. Ibáñez
Dr. Homer A. Neal
Mr. Wesley S. Williams, Jr.

SMITHSONIAN NATIONAL BOARD

Hon. Max N. Berry, *Chair*
Hon. Marc Leland, *Vice Chair*

Mrs. Carolyn Blount
Mr. Lafayette H. Caldwell III
Mr. Peter R. Coneway
Mr. Thomas E. Congdon
Mr. Frank Arthur Daniels, Jr.
Mr. Archie W. Dunham
Dr. Sylvia Earle
Mrs. Jane Eisner
Mrs. Patricia Frost
Ms. Nely Galan
Mr. Bert Getz
Mr. Stephen Hamblett
Mr. Frederic C. Hamilton
Mr. Paul Hertelendy
Mr. Robert L. James
Mrs. Dona Kendall
Mrs. Marie L. Knowles
Ms. Elizabeth S. MacMillan
Mr. John Macomber
Mrs. Holly Williams Madigan
Mrs. Millicent Mailliard
Mr. Michael P. McBride
Mrs. Nan Tucker McEvoy
Mr. Kenneth B. Miller
Hon. Norman Y. Mineta
Mrs. Susan Reed Moseley
Mr. Thomas D. Mullins
Mr. Henry Muñoz III
Mrs. Nancy Brown Negley
Mrs. Mary Ourisman
Mr. James Patton, Jr.
Mr. Heinz C. Prechter
Mr. Thomas F. Pyle, Jr.
Baron Eric de Rothschild
Mr. David M. Silfen
Mr. Kenneth L. Smith
Mr. Kelso F. Sutton
Mr. Jackson Tai
Hon. Frank A.Weil
Mr. Anthony Welters
Mr. Daniel W. Yohannes

HONORARY MEMBERS
Mr. Robert McC. Adams
Mr. William S. Anderson
Mr. Richard P. Cooley
Mr. Joseph F. Cullman III
Mr. Charles D. Dickey, Jr.
Mr. Alfred C. Glassell, Jr.
Mr. I. Michael Heyman
Mrs. Jean Bronson Mahoney
Hon. George C. McGhee
Justice Sandra D. O'Connor
Mr. S. Dillon Ripley
Mr. Francis C. Rooney, Jr.
Mr. Wilbur L. Ross, Jr.
Mr. Lloyd G. Schermer
Mrs. Gay F. Wray

FOUNDERS
S. Dillon Ripley Edward K. Thompson

PUBLISHER EMERITUS
Joseph J. Bonsignore

"A prediction:
The [Meade] ETX-Autostar concept will go down as the greatest happening in amateur astronomy yet."

— *Sky & Telescope* magazine

MEADE
ETX-90EC Astro Telescope

Let Meade ultra-high-resolution optics take you on an automatic guided tour of the heavens. The rings of Saturn, the Orion Nebula, the Andromeda Galaxy, or any of 14,000 other celestial wonders stored in the Autostar hand controller's database. Select an object, press GO TO, and watch as the ETX-90EC moves to the object, places it in the field of view, and tracks it across the sky — *automatically, first time, every time!*

Call **1-800-62-MEADE** for a free copy of Meade Telescope Catalog #134 or for a dealer location near you. ETX-90EC: $595. complete with 4-speed electronic hand controller (not shown). #497 Autostar Computer Controller: $149. Meade telescopes and accessories are available at over 3000 Meade dealer locations in the U.S.A. and Canada.

RITZ CAMERA 1 HOUR BIG PRINT
1-800-52-FOCUS
ritzcamera.com

natural wonders
1-800-2-WONDER
naturalwonders.com

STORE OF KNOWLEDGE
1-800-SHOP-SOK
storeofknowledge.com

Discovery CHANNEL STORE
1-877-DCISTORE
discovery.com

THE NATURE COMPANY
1-877-DCISTORE
discovery.com

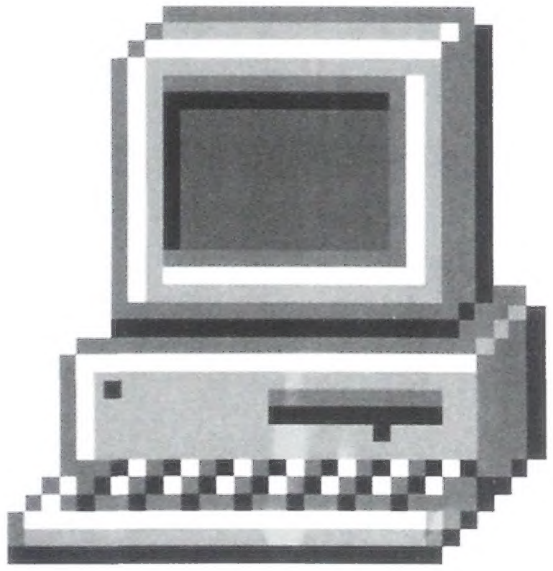
amazon.com

MEADE INSTRUMENTS CORPORATION 6001 Oak Canyon, Irvine, CA 92618. (949) 451-1450. FAX: (949) 451-1460. www.meade.com

The largest-selling telescopes in the world • A NASDAQ Company

©2000

Defined Asset Funds® are now available at a convenient location near you.



It doesn't get any easier than this, because now all you have to do is visit our new site, day or night. And you'll find what you need to know about Defined Asset Funds,® including the latest quotes.

Defined Asset Funds (also known as unit investment trusts) let you know exactly which stocks or bonds you're investing in. So it takes some of the guesswork out of investing—along with some of the worry.

So visit us at definedfunds.com. Or, for a copy of our brochure, call 1–877–DEFINED, ext 4021.

Go To: definedfunds.com

Defined Asset Funds®

BUY WITH KNOWLEDGE. HOLD WITH CONFIDENCE.

Merrill Lynch • Salomon Smith Barney • PaineWebber • Morgan Stanley Dean Witter

A free prospectus containing more complete information on any Defined Asset Funds, including risks and expenses, is available from any of the Sponsors listed above. *Please read it carefully before you invest or send money.*
© 2000 Merrill Lynch, Pierce, Fenner & Smith, Incorporated. Member SIPC.

Smithsonian

EDITORIAL & PUBLISHING OFFICES:
900 Jefferson Drive, SW
Rm 1301, MRC 406
Washington, D.C. 20560

INTERNET ADDRESS:
www.smithsonianmag.si.edu

SUBSCRIPTIONS: 1-800-766-2149
[outside of U.S., call 1-904-445-4662]

PUBLISHER
Ronald C. Walker
Michelle A. McMahon,
Executive Assistant

ADMINISTRATION
Valerie Martin, *Business Manager*

CIRCULATION
Scott I. Rockman, *Associate Publisher*
Carolyn Topak, *Marketing Director*
Elizabeth Hopkins, *Planning Director*
Andrea Sole, *Fulfillment Director*

PRODUCTION
E. Cherry Doyle, *Director*
Greg Williams, *Quality Manager*
David Sterling, *Editorial*
Katherine Balch, *Advertising*

ADVERTISING
David C. Cator, *Associate Publisher*
Lorraine Sakli, *Marketing Director*

NEW YORK 420 Lexington Avenue
Suite 2335, New York, NY 10170-0084
212-490-2510 ◆ fax: 212-986-4259

ATLANTA Brown & Company
770-998-2889 ◆ fax: 770-552-8250

CHICAGO Warden, Kelley, Allen & Opfer
312-575-1100 ◆ fax: 312-575-1107

DETROIT Heth & Associates Inc.
248-642-7273 ◆ fax: 248-642-1321

LOS ANGELES
Charles E. Schmuck & Associates
310-478-3833 ◆ fax: 310-478-1633

SAN FRANCISCO
Charles E. Schmuck & Associates
415-986-1945 ◆ fax: 415-986-1159

TOKYO
International Communications Inc.
81-33-593-1441 ◆ fax: 81-33-580-0414

MEXICO
Towmar Representaciones Profesionales
525-395-5888 ◆ fax: 525-395-4985

SMITHSONIAN BUSINESS VENTURES

Gary M. Beer
Chief Executive Officer
Jeanny Kim
Executive Assistant

BOARD OF DIRECTORS
Thomas Kenney
Chairman

Robert Fri — Constance B. Newman
Ronald Ruskin — Anthony Welters

THE TOOL THAT'S BEEN TO THE SOUTH POLE, MT. EVEREST AND THE AMAZON RIVER IS NOW READY FOR ANOTHER CONQUEST.

Leatherman multi-tools have been to the ends of the earth. And just about everywhere in between. In fact, our engineers have conquered yet another frontier: The picnic. Introducing the Flair. A multi-tool designed to cleverly pop a wine cork, skewer a cocktail weenie, or tighten the bolts on a picnic table. In fact, the corkscrew on the Flair incorporates a professional-style assist, making it far more useful than those found on other tools. Looks like the first name in multi-tools is still first when it comes to innovations. Obviously, no one else can say that.

LEATHERMAN® ONE TOOL. A COUPLE THOUSAND USES.®

Available in sporting goods and hardware departments of retailers worldwide.

NO ONE ELSE L CAN SAY THAT

FLAIR.

SPECS

- NEEDLENOSE/ REGULAR PLIERS
- HARD-WIRE CUTTERS
- CORKSCREW WITH ASSIST
- STRAIGHT/ SERRATED KNIFE
- SCISSORS
- COCKTAIL FORK
- SPREADER KNIFE
- CAN / BOTTLE OPENER
- XS / M / L SCREWDRIVERS
- PHILLIPS SCREWDRIVER
- RULER (6 in)
- 25 YEAR WARRANTY

800-762-3611 www.leatherman.com

Whole Worlds to Order

A NOTE FROM THE SECRETARY

WE'VE FINALLY DONE RIGHT BY OUR DOWNTOWN ELEphant. I mean the one that has stood for decades in the entrance hall of the National Museum of Natural History. Until last year, the elephant existed in featureless isolation. It might as well have risen out of the lobby floor. Today, thanks to the work of the Smithsonian's Office of Exhibits Central (OEC), a scene envisioned by Natural History staff has been brought to life, and the great beast walks on an elevated plateau of reconstructed African landscape, accompanied by birds, bugs, butterflies, a twisty snake and—the crowning touch of OEC's realist fabricators—elephant dung. The elephant looks right at home. And on one side of the high display, fitted into the construction like a window out to the world, a panoramic trio of monitors shows whole herds of elephants in their teeming natural habitat.

Signs in several places on the exhibit ask that visitors look but not touch. But who can resist? On a recent afternoon, child after intrigued child put a hand to the huge mass of counterfeit earth, so realistic and attractive did it seem to them—and at least one tried to reach the filmed elephants through the screens.

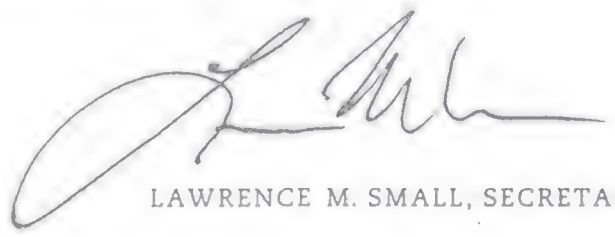
Thanks to the Office of Exhibits Central, an African elephant looks right at home.

The display is a triumph for the staff of OEC, but triumphs are routine for these talented folk, whose quarters are in an old warehouse building near Washington's Union Station. OEC craftspeople take on more than 100 assignments annually, for nearly every museum and research program in the Institution. And their work does not just stay put in Washington, D.C. Anyone who's ever felt the cold fear brought on by the three words "some assembly required" will understand why institutions around the country appreciate the extra measure of care OEC staff put into the design of our traveling shows.

Every museum exhibit starts as an idea, which must be brought to life with objects in a context that is both intellectual and physical. Enter the staff of OEC. In partnership with curators and museum directors, they transform ideas into exhibit plans. They build the first small models of the exhibit; they make the stands and the display cases, the mannequins and the dioramas; they edit the words and make the labels that allow the exhibit to be understood; and they often rig the lighting that lets it be seen. They work their magic on wood, metal, plastic, glass, paper, clay, cloth and just about any other material that suits the purpose. For our permanent minerals exhibit in the National Museum of Natural History, OEC combined a section of the interior of a real copper mine with an artificial section, and did it so ingeniously that the one is indistinguishable from the other and the seams don't show.

OEC craftspeople can make whole worlds to order. Sometimes they re-create moments or objects that can be measured against the originals. For a current show marking the 300th birthday of the piano, they built several cutaway models to demonstrate the increasingly robust action of piano mechanisms over the centuries.

But in other instances, the OEC artisan's hand moves to the dreamer's imagination. For a show that will open next year, the task is to create a mini-diorama of the prehistoric seafloor. The model-maker (guided by the curator) turns to the evidence in British Columbia's Burgess Shale, which holds sea creatures buried by mud more than half a billion years ago. Many of the fossils have only a length and a width, and science has guessed at their original appearance, but we cannot know it for sure. So the model-maker is finally left to surmise. He pores over pictures of the rock, traces the striations, evaluates the scientific evidence, picks the brains of paleontologists and then shapes the clay models from which molds will be made for the diorama's eventual cast-resin population. He erases eons and restores to the hapless creatures their lost dimension. Which is workaday magic at OEC.



LAWRENCE M. SMALL, SECRETARY

TERRY G. MCCREA, SI

A Bowl a Day Helps You Fly Away.

Don't let this opportunity fly by you. Collect certificates from specially marked boxes of Kellogg's® cereal and redeem them for American Airlines® AAdvantage® Miles. For every five certificates you send in, you'll receive 500 AAdvantage Miles. Best of all, the sky is the limit – there is no maximum number of miles you can earn!

Let Kellogg and American Airlines help you turn your mornings into miles for the trip you've been waiting to take.

Kellogg's®

AAdvantage®
American Airlines®

CHARLIE MOHR

I WAS DEEPLY MOVED BY "REQUIEM for a Middleweight" by Jim Doherty, which appeared in your April 2000 issue. The evenhandedness of the article showed careful research into the life and unfortunate death of intercollegiate boxing champion Charlie Mohr and the subsequent demise of college boxing. I have two sons who are active in sports. I know what a difference sports can make in a young man's outlook about himself, but I also know the pressures of not letting down the team or the fans. One of my sons has changed in many ways since he went off to college, where the expectations of him are greater and where he takes his responsibilities more seriously.

I cannot imagine the grief of losing a child or how my sons would handle losing a friend. The grief shone through between the lines of your fine story about this remarkable yet troubled young man, and I shared Mr. Doherty's sadness in still missing him so many years later.

Sherry Lambert
South Bend, Indiana

AFTER 40 YEARS, THE FACTS SURrounding the death of my friend and teammate Charlie Mohr have been brought to light by Jim Doherty. I remember Charlie as a prince among men and a champ among champions. It was obvious his problems should have precluded him from fighting that night. It was equally poor judgment for the officials to allow the bout to continue, even briefly, after Charlie was stunned and knocked down.

Unfortunately, the system and those in whom he had placed his trust failed to protect him. The misrepresentation of the facts in the false hope of saving boxing was an insult to his memory. Boxing did not cause Charlie's death; human frailty did.

Wally M. DeRose
Schererville, Indiana

MY FATHER AND I ATTENDED THE fight between Joe Louis and Johnny Paychek on March 29, 1940, in New York City, not Chicago as you stated, at the old Madison Square Garden.

Richard G. Rumery
Short Hills, New Jersey

PETAL POWER

HUMANS WERE NOT THE ONLY SPEcies attracted to the dahlia on your April cover. I had just seated myself on my back patio, SMITHSONIAN in hand, when a blue-throated hummingbird hovering inches from my face startled me. I uttered, "Oh," and as he flew away to a real flower, I realized he had been attracted to the artistry of photographer Amy Lamb.

Florence Winslow
Tucson, Arizona

AS A RED-GREEN COLOR-BLIND PERson, I am often aware from the comments of others that I am missing out on something. With the stunning photographs of flowers by Amy Lamb, I am very thankful to God for what I can see.

Torre Rarden Bissell
Schenectady, New York

FOR MY SEVENTH-GRADE MATH CLASS at Langston Hughes Middle School, I recently reported on the Fibonacci number sequence, an infinite series of numbers (*0, 1, 1, 2, 3, 5, 8, 13, 21, 34* . . .). The first two terms are 0 and 1, and each succeeding term is the sum of the two terms preceding it (0+1=1; 1+1=2; 2+1=3; 3+2=5; 5+3=8; 8+5=13; 13+8=21 and so on).

I also learned that the Fibonacci sequence occurs in spirals in nature: the number of spirals in a pattern in nature is a number in Fibonacci's sequence. When I came upon Amy Lamb's photographs in your magazine, I was pleasantly surprised because I could see this borne out. The most noticeable are the hydrangea with its three blue petals and the magnolia with its layered diagonal pattern of eight in its pineapple-shaped pistil. Some people may say it is chance, but maybe it makes the flowers more beautiful.

Matt Brooks
Reston, Virginia

THE PROFOUND BEAUTY, ELEGANCE and liquid sensuality of Amy Lamb's cover photograph stopped me in my tracks. Her accompanying picture portfolio provided more breathtaking glimpses of our world, seen through the eyes of one who loves it.

Greg Jones
Prescott, Arizona

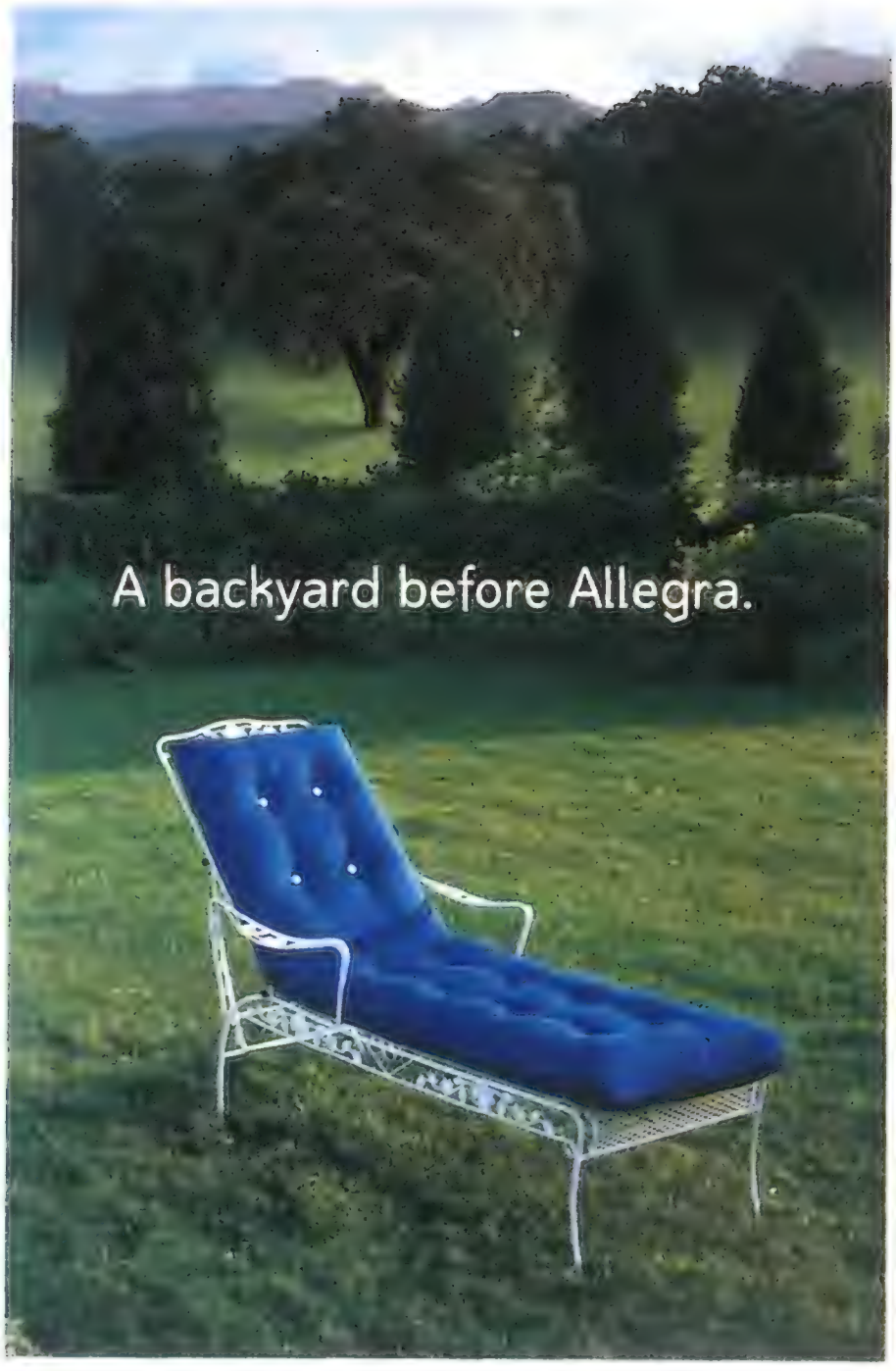
AROUND THE MALL & BEYOND

IN MICHAEL KERNAN'S "BONE SPEcialist On Call" you mentioned several recent disasters where National Museum of Natural History anthropologist David Hunt and his colleagues have helped identify bodies. The Smithsonian's involvement in such cases goes back many decades. In the early 1950s, T. Dale Stewart, senior anthropologist at the Smithsonian, provided incalculable assistance to the American Graves Registration Services Group in Kokura, Japan, in identifying the remains of unknown war dead that were recovered in Korea and adjacent waters.

Clyde W. Everson
Monroe, Ohio

BOOK REVIEWS

YOUR REVIEW OF JOHN N. MACLEAN'S *Fire on the Mountain: The True Story of the South Canyon Fire* erred in placing Storm King Mountain in Grand Junction, Colorado. It is about 7 miles



Only Allegra has fexofenadine for effective nondrowsy relief of seasonal allergy symptoms. For people twelve and older. Ask your doctor or pharmacist for more information. Side effects are low and may include drowsiness (1.3%), cold or flu (2.5%), nausea (1.6%), or menstrual pain (1.5%).

nondrowsy
allegra®
fexofenadine HCl 60mg capsules

Enjoy the world around you.™

1-800-ALLEGRA www.allegra.com

Please see additional important information on the next page.

©1999, Hoechst Marion Roussel, Inc.

ALLEGRA
(fexofenadine hydrochloride) Capsules
60 mg

INDICATIONS AND USAGE

CONTRAINDICATIONS

PRECAUTIONS
Drug Interactions

Effects on Steady-State Fexofenadine Pharmacokinetics
After 7 Days of Co-Administration with Fexofenadine Hydrochloride
120 mg Every 12 Hours (twice recommended dose)
in Normal Volunteers (n=24)

Carcinogenesis, Mutagenesis, Impairment of Fertility

Pregnancy
Teratogenic Effects: Category C

Nursing Mothers

Pediatric Use

Geriatric Use

ADVERSE REACTIONS

Adverse Experiences Reported in Placebo-Controlled Seasonal Allergic Rhinitis Clinical Trials at Rates of Greater Than 1%

Hoechst Marion Roussel

Hoechst

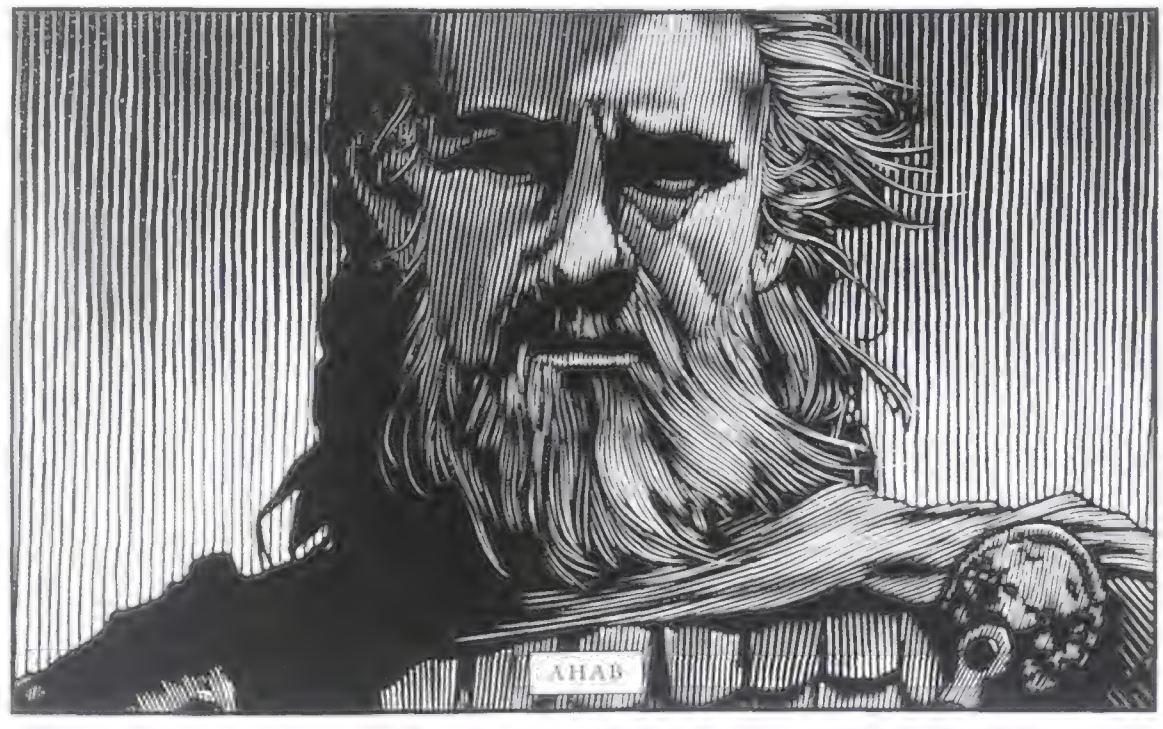
Serious Sun Protection

Recommended by dermatologists, Solumbra® by Sun Precautions is the first line of clothing to meet published medical guidelines for sun protection. Soft, lightweight and comfortable, our patented fabric offers 30+ SPF sun protection and blocks over 97% of harmful UVA and UVB rays—more than a typical sunscreen or summer shirt. For a FREE catalog of Solumbra hats, shirts, pants and accessories, call Sun Precautions:
1-800-882-7860.

Solumbra®
Medically Recommended
Sun Protective Clothing

MEDICAL DEVICE SOLUMBRA SUN PROTECTIVE CLOTHING

ADSMKI



THE PENNYROYAL CAXTON BIBLE

DESIGNED AND ILLUSTRATED BY BARRY MOSER

Printed in an edition of 400 handmade copies • Illustrated with 232 original engravings printed from the blocks • Two volumes, 11 x 15 inches, full linen vellum bindings • $[illegible]
Thirty copies of a deluxe edition, presented in seven volumes, are available at $[illegible]
The trade edition is from Viking Studio and is available at fine bookstores everywhere.

PENNYROYAL CAXTON PRESS • 413.247.9358 • CMOSER@PENNYROYAL-CAXTON.COM

"I cannot imagine the culmination of a lifetime of wisdom" — The Washington Post
"Mr. Moser may just have created the Bible for our time" — The New York Times

from Glenwood Springs and about 90 miles from Grand Junction.

Kay L. Poston

Aurora, Colorado

Ms. Poston and John N. Maclean's book are correct; our review was not. Ed.

JOHN STILGOE

THANK YOU FOR "READING THE MESsages in Everyday Things" by Richard and Joyce Wolkomir. When I see utility poles in parts of Minneapolis, I know how John Stilgoe must feel when he "just notices things." Homemade signs attached to utility poles are interesting to read, but equally interesting are the methods by which they are attached to the wooden poles. Free of signage, a pole is carpeted with a mix of embedded or bent nails, tacks, pins and industrial or office staples. In Northeast Minneapolis, an older part of town, the variety of sizes and the vintages of nails is fascinating

Around the University of Minnesota and in areas with apartment buildings, staples are preferred, and colorful paper from quick-copy shops predominates. The visual cacophony from multiple layers of paper, each crying out for the eye, gives the pole a middle-age spread. Interestingly, the boulevard trees were spared the staple gun and the hammer and nail.

The utility pole microcosm could be a gold mine for Stilgoe.

Walt Flugel

Grantsburg, Wisconsin

JOHN STILGOE SHOULD CONSIDER current events when looking around at urban landscapes. As he said, some architects may have thought the concrete bollards embedded in a sidewalk's edge "looked nice," but now the cylinders are sometimes installed as protective barriers that may hinder drive-up terrorist bombings.

Cherisa Burk

North Haledon, New Jersey

WRITE TO SMITHSONIAN

Letters for consideration in this column must include your daytime telephone number, full name and postal address. Transmit mail to LettersEd@simag.si.edu or send it to Smithsonian Letters Editor, P.O. Box 44400, Washington, D.C. 20026-4400. Letters may be edited for clarity and length.

Send queries and comments about the Smithsonian Institution to info@info.si.edu or to VIARC, Public Inquiry Mail Service, Washington, D.C. 20560-0010.

Technogenesis®

\tek-nō-jén-ə-səs*n:*

the educational frontier wherein students, faculty and industry jointly nurture new technologies from concept to realization.

At Stevens Institute of Technology, education that brings about new technology is a way of life. We call it technogenesis. It's not just a fancy word. Our faculty, students and alumni illustrate why. Stevens defines the direction and programs for technological education that prepare leaders and innovators to succeed in any profession. And just as importantly, the institute is committed to learning throughout the process of conception, design and marketplace realization of new technologies. Is it any wonder that Stevens brings the world so many of the technologies people take for granted today? We think not.

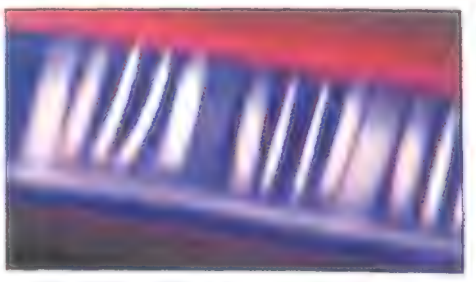
STEVENS
Institute of Technology

1-888-592-1870 • *www.stevens-tech.edu*

CASTLE POINT ON HUDSON, HOBOKEN, NEW JERSEY 07030

We're developing new technology to assure the structural integrity and safety of aircraft, bridges and pipelines.

We've invented innovative water treatment technologies to remove dangerous contaminants from drinking water.



Our breakthrough plasma technology is yielding new ways to rid the environment of harmful pollutants.

POINTS OF INTEREST

Camping in Concert

AT THIS OUTDOOR FOLK-MUSIC FESTIVAL IN RURAL TEXAS, YOU'RE NOT A "KERRVIVOR" UNLESS YOU STAY TILL THE END

BY MINNA MORSE

At an impromptu gathering (above), musicians do what comes naturally outside a country store at the Kerrville Folk Festival. At night (below), fans dance during a concert.

I HAD JUST FALLEN INTO A deep slumber when my friend Larry clanked a metal coffee mug against the corner of a nearby trailer. "Rise and shine, sleepyhead," he chirped to me in his resonant Texas twang. I thought about burrowing deeper into my sleeping bag. I fantasized about clanking that mug upside Larry's head. Then I gave in and, on only a few hours' rest, crawled out of my tent into a brand-new day of song.

Shielding my eyes from the glaring Texas sun, I wondered how the regulars here survived night after night of playing music round the campfires. All that kept me from crawling back into my tent was the smell of coffee brewing at the makeshift country store across the road, the faint strumming from a few musicians already gathering at the picnic tables there and the fear that Larry might clank his mug once more. Instead, he brought me a cup of joe.

This was morning at the annual Kerrville Folk Festival, an 18-day celebration in the rolling hill country of Texas. While by no means the largest event of its kind or the best known, Kerrville runs the longest and, among the musicians who play there, is the most beloved. On three outdoor stages, it showcases the talents of more than 75 featured performers and groups, offering as many as four concerts a day. In the 28 years since it was founded by former race-car driver and radio host Rod Kennedy, it has grown from a three-day affair to a marathon that draws tens of thousands of fans from all over the country.

Set on a 50-acre ranch nine miles from the town of Kerrville, a little more than an hour's drive northwest of San Antonio, the festival has become a coveted venue for established stars like Mary Chapin Carpenter and Peter Yarrow of Peter, Paul and Mary. But it also provides a temporary village for a tightly knit community of more than 3,000 devotees who camp out and make music—or just listen—pretty much round the clock. For the aspiring musicians among them, it offers a chance to schmooze and jam with some of the country's best.

American Partnership

It's believing that together, we are stronger.

It's striving to improve not just your results, but our relationship.

It's knowing the ultimate measure of our performance is your success.

American Century

American Century®

Investment Management

www.americancentury.com

A trio of true believers gets groovy (above) next to an RV-modified school bus. Camping in tents (top) and tarps is an integral part of the Kerrville experience.

About 550 of those making camp here are volunteer staff members, working to earn their meals and tickets. There are cooks and crafts vendors, stage crews and latrine cleaners. There's Happy Jack, the camp embroiderer, and Cookie, who'll sharpen your knives. There's even a squad of massage therapists who offer daily rubdowns to tired personnel. And then there's Larry, who works security with his mom, Lenore, stepdad, Vern, and their camp neighbor, a former clown named Sticky Paul.

Vern, a baker and talented woodworker, and Lenore, a philosophy professor, met at Kerrville and were married here under the Ballad Tree up on Chapel Hill. An abbreviated version of their joint moniker, LeVern, is displayed on the license plates of their motor home, which occupied the dusty patch of ground where I stood drinking my coffee. "This here," Vern told me proudly, referring to his vehicle and several other trailers and tents clustered nearby, "is Camp Peace of Mind." Scattered across the landscape were hundreds of similar "camps" with all sorts of shelters, from three-walled "cabins" to the full-sized tepees that go up each year down in the meadow.

A sprightly guy with a full white beard and rainbow-colored beret, Vern seemed to have endless reserves of energy. Though he really needed to run off somewhere, he took the time to explain Kerrville's lexicon to me, from "Kerrgins" (first-timers) to "Kerrverts" (converts to the musical and spiritual high that is Kerrville) to "Kerrvivors" (anyone who stays the whole three weeks, as he and Lenore do). Never, I noted—fighting off a sleepy yawn—did he mention "Kerrfew."

I would be there only a few nights—a lengthy stay at most music festivals, perhaps, but an unusually brief one for Kerrville. I had always loved folk music—from political rally-cries, like those of Woody Guthrie or Bob Dylan, to romantic ballads; from country-blues to "world beat"—but I'd never become a regular on the folk circuit. I'd never hung out. But this time, I resolved to do just that.

I'd arrived on the Sunday of Memorial Day weekend, the first weekend of the festival, in time to see some of my favorites play at the evening Main Stage concert. The Four Bitchin' Babes were on the program, as was Ellis Paul, an artist I had discovered four years earlier, during my only other visit to Kerrville. A Boston-based musician who writes songs that, says Mike Joyce of the *Washington Post*, "draw you in just as surely as a whispered secret," Paul had been on the Main Stage for the first time that year. The year before, in 1994, he'd won the Kerrville New Folk competition, an event that helped launch the careers of such popular performers as Lyle Lovett and Nanci Griffith. At each festival, the New Folk competition features singer-songwriters from across the country who may have local followings but are not yet nationally known.

This time around, I encountered Kevin So, another artist who'd gone from New Folk to Main Stage performer—though, unlike Paul, he hadn't won the award. He had come to Kerrville for the first time in 1996, "with absolutely no dough," and worked selling festival merchandise. After he was invited to be in the New Folk competition the following year, many of the volunteer staff showed up to root for him. Just two years later, he was featured on the Main Stage on Saturday night of the festival's opening

Blue jeans

help keep cars quiet.
Who thinks this stuff up?

The Ford Focus was born with a keen eye, or in this case an ear, toward inventive recycling. That's why we stop for jeans. Admittedly we're not particular about style or cut. We want them well worn and ready for the shredder so they can be treated and bonded and packed under the hood as sound-deadening material in every Focus we build in Saarlouis, Germany.

Liz Tait, in her role as our Minister of Denim, thinks jeans could be good for a lot of things after they've finished being good to you.

WWW.FORD.COM	COMPONENTS:	BETTER IDEA #10
	Cotton fibers	
	LONDON, ENGLAND	

Ford Motor Company

© 2000 Ford Motor Company

weekend. He was still revved from his crowd-pleasing performance when we spoke backstage.

So is a Chinese-American singer and songwriter whose work sometimes draws on that heritage but also ranges from blues to R & B to romantic ballads. He has acquired a large following at the festival—a process that began long before Saturday night's concert. "This place is all about the campfires," he told me. "That's where you really lay it *down*," chimed in his friend, singer Stephanie Corby.

With that idea in mind, I headed off into the night on Sunday, with Larry as my guide, going from campfire to campfire. Or gathering to gathering, to be more accurate, for the circles were for the most part lit by kerosene lamps. And they were everywhere. "Hey, will you look at that," Larry said gleefully as we passed a crossroad by the latrines, where a cluster of people stood around the glow of a streetlight. "It's a *bleeping* jam in the fork in the road."

Ellis Paul performs on one of Kerrville's three outdoor stages. In 1994, he won the festival's competition for new singer-songwriters.

I was like a kid in a candy store, entranced by all the possibilities and unable to commit to any one choice. At some point, Larry let me go off on my own, and I wandered from campfire to circus tent to tarp, wherever I heard music, staying here for five minutes to hear a woman sing out against corporate greed, and there to hear a folk-circuit elder masterfully pick a tune and then respectfully turn to a young kid who offered a heartfelt, albeit naive, new ballad.

As the night wore on, I tried desperately to find Camp Cuisine and Camp Nashville, the two places that I'd heard attracted the most talented musicians. I was so eager to have a genuine "campfire experience" that I didn't actually experience much at all. I just kept wandering from one thing to another until finally, exhausted, I crawled into my sleeping bag. And then morning came, with Larry's clanking mug.

Monday's schedule was full—from a four-hour blues show, to the daily song-sharing under the Ballad Tree—capped off in the evening by a phenomenal lineup at the Main Stage. Like the night before, and the night before that, the theater area filled up with some 4,500 Kerrverts and other visitors for a six-hour, seven-act concert. At the end, Kerrville stalwart Peter Yarrow took the stage for his annual birthday sing-along.

As his set went on, Yarrow kept inviting more and more younger musicians to join him—including Kevin So—until the stage seemed almost as crowded as the audience. In his memoir, *Music From The Heart*, founder Rod Kennedy recalls an earlier festival: "The evening finale featured Peter Yarrow, reinforcing the togetherness he had helped to build from the beginning. . . . The audience joined in singing with damp eyes . . . almost not believing that this feeling of belonging together could move them so much."

All right, so it's sappy. OK, so I'm a sucker. But when the musicians and kids on that jam-packed stage started swaying and singing "Puff the Magic Dragon," it did my poor heart in.

After the concert, I was all set to hit the campfire circuit once more. But, I learned, that night—the end of the festival's five-day opening rush—was listed on the calendar (the "Kerr-lendar") as the "First Night of Sleep." After Yarrow's set, there was some faint strumming to be heard from far-flung corners of the ranch, but for the most part, by 2 A.M. or so, people had settled in.

Disappointed, I'd begun walking back to my tent when I suddenly heard the familiar voice of Ellis Paul and, sure enough, there he was, surrounded by a few stragglers at the corner Larry had dubbed the "jam in the fork in the road." Among them was Stephanie Corby, Kevin So's friend, singing harmony. Eventually Paul invited a few of us back to his camp, where he promised Stephanie he would do one more number.

So, finally, I got to see Camp Nashville. The night before, this Holy Grail of the campfire scene had doubtless been alive with song, crowded with musicians waiting their turn. Now it was quiet, with only the camp's residents lounging around before heading into their tents.

And then, lit by the moon, before a silhouette backdrop of the Texas hills, Corby joined Paul for one more song—titled, appropriately enough, "Last Call." Their voices floated up through the night sky, clear and sweet and pure. And as I sat there listening—sleep-deprived and beaming—I realized that the Holy Grail had indeed been found. I was now a Kerrvert. There would be no turning back.

STEVE RAWLS

dinner for 8, chez marcella: $475

one happy birthday card: $1.95

one leopard-print, peekaboo nightie: $45

still being able to make her blush:

there are some things money can't buy.
for everything else there's MasterCard.®

MasterCard

www.mastercard.com

The "Indomitable" MRI

RAYMOND DAMADIAN'S MEDICAL IMAGING MACHINE SET OFF A REVOLUTION—BUT NOT WITHOUT CONTROVERSY

BY JULIE WAKEFIELD

IN THE VAST ARCHIVES of the Smithsonian's National Museum of American History resides the title of ownership to a machine named Indomitable that represents a milestone in the history of medical imaging. Its story is a timeless one of a driven inventor who perseveres through every obstacle only to find that others are racing along similar paths, which in this case led to today's ubiquitous magnetic resonance imaging (MRI) machines.

Raymond Damadian poses with the first whole-body MRI scanner at the National Museum of American History, c. 1989.

Columbia University professor Isidor I. Rabi first observed the quantum phenomenon dubbed nuclear magnetic resonance (NMR) in 1937. He recognized that atomic nuclei betray their presence by absorbing or emitting radio waves when exposed to a sufficiently strong magnetic field. Within a decade of Rabi's discovery, chemists and physicists had adopted NMR as a standard analysis for substances. But 30-some years would elapse before anyone even considered using the method to scan a breathing human body for cancer.

Enter Raymond Damadian. An experimenter at heart, he brought a fresh perspective to NMR—that of a physician. He had earned a medical degree at Albert Einstein College of Medicine in the Bronx and pursued his medical research career at Brooklyn's Downstate Medical Center.

Damadian's first foray into the field of imaging began when, during a postgraduate stint at Harvard University, he experienced excruciating abdominal pains. Doctors detected nothing using x-rays or other conventional methods short of surgery. Damadian decided a better way must be found to examine the inner workings of the body.

The proverbial lightning bolt struck Damadian in 1969, after he used an NMR machine to investigate his ideas about electrically charged particles in the body. His associate Freeman Cope, a Navy physician and physicist, brought him to a small company on the outskirts of Pittsburgh where the two measured potassium, a common electrolyte, in a strain of Dead Sea bacteria.

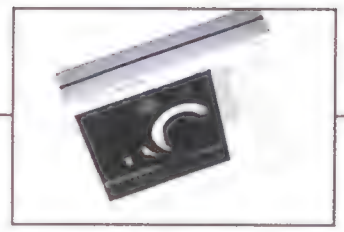
At breakfast a few mornings later, Damadian wondered aloud about what would happen "where you have an antenna wrapped around the human body, where you can look at an atom, and then another atom, and then another atom—you could go from one tissue to the next and, without ever invading the body, get the chemistry of each organ." Even Cope thought Damadian's idea far fetched, but Damadian committed himself to the quest.

In 1970 Damadian returned to test cancerous liver samples from rats with the NMR equipment. On the basis of his electrolyte work, he surmised that the hydrogen signal in cancerous tissue might differ from that of healthy tissue because tumors contain more water. More water meant more hydrogen atoms—two per water molecule. Once the bath of radio waves was switched off, telltale emissions from the cancerous regions would linger longer than those from the healthy, less aqueous regions. It worked. The journal *Science* published his findings in March 1971. Cancerous tissues could now be detected in humans without resorting to radiation, he reasoned, if a large-scale scanner could be built.

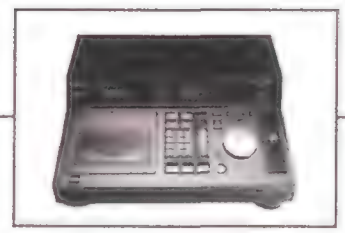
Later that same year, Paul Lauterbur, a chemist and NMR pioneer at the State University of New York, Stony Brook, conceived of a way to use NMR to produce an image. His idea, documented in a notebook, entailed using magnetic field gradients to map out a series of points. In 1973 Lauterbur produced the first NMR image of a small

1970
Revolutionary
Direct Drive
Turntable

1977
Open Reel
Tape Recorder



1981
Programmable
Linear Tracking
Turntable



1989
Professional
CD Player

1995
Home Theater
Receiver

30 years of creating pure sound.

2000
DVD Audio

Since 1970, we've been turning the music world on its ear. Wait'll you hear what we've got coming this summer.

Technics 30TH ANNIVERSARY

Technics

The science of sound
pure sound

amount of water in a test tube, a feat he published in the journal *Nature*. Soon after, he imaged the first live subject: a tiny clam.

Though Lauterbur's gradient approach quickly gained favor over Damadian's human scanner method, Damadian filed for a patent on his concept in 1972 and received it in 1974. He forged ahead, determined to make the first human scan. Aided by graduate students, he built the heart of Indomitable, a homemade superconducting magnet, from roughly 30 miles of niobium-titanium wire wrapped on a cylinder. The magnet, a hollow cylinder, spanned 53 inches in diameter, big enough to swallow up a human. On top, the team installed an elaborate liquid helium cooling system to keep resistance in the wire near zero. But the helium leaked miserably, costing $2,000 a week and reducing the magnet's strength.

Without time for modifications, Damadian pushed his team onward. Mike Goldsmith, one of his graduate students, cobbled a wearable antenna coil fashioned from cardboard, capacitors and copper wire. Others fine-tuned the rest: an oscilloscope to monitor the hydrogen broadcasts detected by the coil; a minicomputer to translate the received signals into an image; and a manually operated wooden platform to move the subject.

Damadian's moment of reckoning finally arrived on May 11, 1977. Inside his Downstate Medical Center lab, he ran through his checklist, a process that took about 12 hours. Approval from the school's Human Experimentation Committee seemed unnecessary. Damadian had volunteered himself as the first guinea pig.

With veiled trepidation, Damadian shimmied into the corsetlike antenna coil and sat down on the movable platform inside his shiny, 1 1/2-ton contraption. Without fanfare, Damadian's assistant powered up Indomitable's systems and subsystems.

Seconds passed. Then minutes. The team couldn't detect any radio signal. A half-hour passed. Still no signal. After hours of tinkering, still nothing. "We were very depressed," Damadian recalls. "We had been telling the whole world that we were going to be able to do this thing and we failed."

Eventually the thought occurred that Damadian might be too corpulent for the feeble coil. Apparently fat insulates the body from more than mere cold weather. For seven weeks after the test, graduate student Larry Minkoff keenly monitored his boss, watching for any odd behavior or ailment. Detecting none, he offered his own svelter torso to science (left).

Larry Minkoff served as a guinea pig for a test of Indomitable on July 3, 1977.

The machine appreciated his lean physique. On July 3, 1977, nearly five hours after the start of this test, Indomitable achieved the first human scan and became the first MRI prototype. The crude image, reconstructed first with colored pencils and then by computer from 106 data points, revealed a two-dimensional view of Minkoff's chest—including his heart and lungs.

Damadian trumpeted Indomitable's success to the media, asserting, perhaps a bit rashly, in a July 20 press release that "a new technique for the nonsurgical detection of cancer anywhere in the human body has now been perfected."

A year later, he founded a company to commercialize the technology. Named for his field focusing approach, the Fonar Corporation marketed its first product in 1980, based on the Indomitable prototype.

Today, Indomitable, minus its electronic subsystems, is prominently displayed at the National Inventors Hall of Fame in Akron, Ohio, on loan from the National Museum of American History. The Hall of Fame inducted Damadian in 1989. A year earlier, Damadian shared the National Medal of Technology with Lauterbur for their independent contributions to MRI technology.

The use of MRI technology, of course, has spread so rapidly that nowadays even dogs and cats benefit from its revealing scans. Improvements to MRI machines have even made it possible to trace thought or perception sequences for brain research.

Despite the technology's success, detractors denounce the first Indomitable image as "meaningless," given its crudeness and vulnerability to bias. Moreover, they view Damadian's so-called breakthrough as a technical dead end: even his own company, Fonar, abandoned the approach and adopted Lauterbur's in the early 1980s. But Damadian considers Fonar's courtroom victory in 1997 over General Electric, which forced the industry giant to award him $128 million for patent infringements, as proof of the priority of his concept.

Raymond Damadian now is racing other experimenters to create a giant MRI machine that will allow surgeons to view patients' interior anatomies while they operate. Historians of science, meanwhile, will review the history of MRI technology to distinguish braggadocio from brilliance, as tough a task as measuring spin on electrons. If claims hold up, someone from the field may again make headlines—as a Nobel Prize winner.

Are you or someone you care for *increasingly*...

Forgetful?
Repeating questions?
Having trouble finding words?

When these problems interfere with everyday life, it could be Alzheimer's disease.

A medicine called ARICEPT® may help.

When you or someone you care for has gradually increasing memory problems, it may not be normal aging. It could be Alzheimer's disease, an incurable, progressive illness.

Today there's hope, including a prescription medicine called ARICEPT®. Once-daily ARICEPT is clinically proven to treat the symptoms of mild to moderate Alzheimer's. In people who respond to ARICEPT®, symptoms may get better, stay the same or progress at a slower rate.

ARICEPT® is well tolerated but may not be for everyone. Some people may experience nausea, diarrhea, insomnia, vomiting, muscle cramps, fatigue or loss of appetite. In studies, these side effects were usually mild and temporary. Some people taking ARICEPT® may experience fainting. People at risk for ulcers should tell their doctors because their condition may get worse.

Only a doctor can say if memory problems are due to Alzheimer's disease. And the sooner you know, the sooner ARICEPT® may help.

So speak to a doctor today and ask about ARICEPT®, the #1 prescribed medicine for Alzheimer's disease.

ONCE-A-DAY
ARICEPT®
(donepezil HCl)
5-MG AND 10-MG TABLETS

MEDICINE TO REMEMBER™

To learn more, call toll-free today.

1-888-999-9616 ext. 94

Please see additional important product information on accompanying page.

ONCE-A-DAY

ARICEPT® (donepezil HCl) 5-MG AND 10-MG TABLETS

MEDICINE TO REMEMBER™

ARICEPT® (Donepezil Hydrochloride Tablets)

Brief Summary – see package insert for full prescribing information. **INDICATIONS AND USAGE** ARICEPT® is indicated for the treatment of mild to moderate dementia of the Alzheimer's type. **CONTRAINDICATIONS** ARICEPT® is contraindicated in patients with known hypersensitivity to donepezil hydrochloride or to piperidine derivatives. **WARNINGS** ***Anesthesia:*** ARICEPT®, as a cholinesterase inhibitor, is likely to exaggerate succinylcholine-type muscle relaxation during anesthesia. ***Cardiovascular Conditions:*** Because of their pharmacological action, cholinesterase inhibitors may have vagotonic effects on heart rate (e.g., bradycardia). The potential for this action may be particularly important to patients with "sick sinus syndrome" or other supraventricular cardiac conduction conditions. Syncopal episodes have been reported in association with the use of ARICEPT®. ***Gastrointestinal Conditions:*** Through their primary action, cholinesterase inhibitors may be expected to increase gastric acid secretion due to increased cholinergic activity. Therefore, patients should be monitored closely for symptoms of active or occult gastrointestinal bleeding, especially those at increased risk for developing ulcers, e.g., those with a history of ulcer disease or those receiving concurrent nonsteroidal anti-inflammatory drugs (NSAIDS). Clinical studies of ARICEPT® have shown no increase, relative to placebo, in the incidence of either peptic ulcer disease or gastrointestinal bleeding. ARICEPT®, as a predictable consequence of its pharmacological properties, has been shown to produce diarrhea, nausea and vomiting. These effects, when they occur, appear more frequently with the 10 mg/day dose than with the 5 mg/day dose. In most cases, these effects have been mild and transient, sometimes lasting one to three weeks, and have resolved during continued use of ARICEPT®. ***Genitourinary:*** Although not observed in clinical trials of ARICEPT®, cholinomimetics may cause bladder outflow obstruction. ***Neurological Conditions:*** Seizures. Cholinomimetics are believed to have some potential to cause generalized convulsions. However, seizure activity also may be a manifestation of Alzheimer's Disease. ***Pulmonary Conditions:*** Because of their cholinomimetic actions, cholinesterase inhibitors should be prescribed with care to patients with a history of asthma or obstructive pulmonary disease. **PRECAUTIONS Drug-Drug Interactions** ***Drugs Highly Bound to Plasma Proteins:*** Drug displacement studies have been performed *in vitro* between this highly bound drug (96%) and other drugs such as furosemide, digoxin, and warfarin. ARICEPT® at concentrations of 0.3-10 µg/mL did not affect the binding of furosemide (5 µg/mL), digoxin (2 ng/mL), and warfarin (3 µg/mL) to human albumin. Similarly, the binding of ARICEPT® to human albumin was not affected by furosemide, digoxin, and warfarin. ***Effect of ARICEPT® on the Metabolism of Other Drugs:*** No *in vivo* clinical trials have investigated the effect of ARICEPT® on the clearance of drugs metabolized by CYP 3A4 (e.g. cisapride, terfenadine) or by CYP 2D6 (e.g. imipramine). However, *in vitro* studies show a low rate of binding to these enzymes (mean K_i about 50-130 µM), that, given the therapeutic plasma concentrations of donepezil (164 nM), indicates little likelihood of interference. Whether ARICEPT® has any potential for enzyme induction is not known. ***Effect of Other Drugs on the Metabolism of ARICEPT®:*** Ketoconazole and quinidine, inhibitors of CYP450, 3A4 and 2D6, respectively, inhibit donepezil metabolism *in vitro*. Whether there is a clinical effect of these inhibitors is not known. Inducers of CYP 2D6 and CYP 3A4 (e.g., phenytoin, carbamazepine, dexamethasone, rifampin, and phenobarbital) could increase the rate of elimination of ARICEPT®. ***Use with Anticholinergics:*** Because of their mechanism of action, cholinesterase inhibitors have the potential to interfere with the activity of anticholinergic medications. ***Use with Cholinomimetics and Other Cholinesterase Inhibitors:*** A synergistic effect may be expected when cholinesterase inhibitors are given concurrently with succinylcholine, similar neuromuscular blocking agents or cholinergic agonists such as bethanechol. **Carcinogenesis, Mutagenesis, Impairment of Fertility** Carcinogenicity studies of donepezil have not been completed. Donepezil was not mutagenic in the Ames reverse mutation assay in bacteria. In the chromosome aberration test in cultures of Chinese hamster lung (CHL) cells, some clastogenic effects were observed. Donepezil was not clastogenic in the *in vivo* mouse micronucleus test. Donepezil had no effect on fertility in rats at doses up to 10 mg/kg/day (approximately 8 times the maximum recommended human dose on a mg/m² basis). **Pregnancy** ***Pregnancy Category C:*** Teratology studies conducted in pregnant rats at doses up to 16 mg/kg/day (approximately 13 times the maximum recommended human dose on a mg/m² basis) and in pregnant rabbits at doses up to 10 mg/kg/day (approximately 16 times the maximum recommended human dose on a mg/m² basis) did not disclose any evidence for a teratogenic potential of donepezil. However, in a study in which pregnant rats were given up to 10 mg/kg/day (approximately 8 times the maximum recommended human dose on a mg/m² basis) from day 17 of gestation through day 20 postpartum, there was a slight increase in still births and a slight decrease in pup survival through day 4 postpartum at this dose; the next lower dose tested was 3 mg/kg/day. There are no adequate or well-controlled studies in pregnant women. ARICEPT® should be used during pregnancy only if the potential benefit justifies the potential risk to the fetus. **Nursing Mothers** It is not known whether donepezil is excreted in human breast milk. ARICEPT® has no indication for use in nursing mothers. **Pediatric Use** There are no adequate and well-controlled trials to document the safety and efficacy of ARICEPT® in any illness occurring in children. **ADVERSE REACTIONS Adverse Events Leading to Discontinuation** The rates of discontinuation from controlled clinical trials of ARICEPT® due to adverse events for the ARICEPT® 5 mg/day treatment groups were comparable to those of placebo-treatment groups at approximately 5%. The rate of discontinuation of patients who received 7-day escalations from 5 mg/day to 10 mg/day, was higher at 13%. The most common adverse events leading to discontinuation, defined as those occurring in at least 2% of patients and at twice the incidence seen in placebo patients, are shown in Table 1.

Table 1. Most Frequent Adverse Events Leading to Withdrawal from Controlled Clinical Trials by Dose Group

Dose Group	Placebo	5 mg/day ARICEPT®	10 mg/day ARICEPT®
Patients Randomized	355	350	315
Event/% Discontinuing			
Nausea	1%	1%	3%
Diarrhea	0%	<1%	3%
Vomiting	<1%	<1%	2%

Most Frequent Adverse Clinical Events Seen in Association with the Use of ARICEPT® The most common adverse events, defined as those occurring at a frequency of at least 5% in patients receiving 10 mg/day and twice the placebo rate, are largely predicted by ARICEPT®'s cholinomimetic effects. These include nausea, diarrhea, insomnia, vomiting, muscle cramp, fatigue and anorexia. These adverse events were often of mild intensity and transient, resolving during continued ARICEPT® treatment without the need for dose modification. There is evidence to suggest that the frequency of these common adverse events may be affected by the rate of titration. An open-label study was conducted with 269 patients who received placebo in the 15- and 30-week studies. These patients were titrated to a dose of 10 mg/day over a 6-week period. The rates of common adverse events were lower than those seen in patients titrated to 10 mg/day over one week in the controlled clinical trials and were comparable to those seen in patients on 5 mg/day. See Table 2 for a comparison of the most common adverse events following one and six week titration regimens.

Table 2. Comparison of Rates of Adverse Events in Patients Titrated to 10 mg/day Over 1 and 6 Weeks

	No titration		One-week titration	Six-week titration
Adverse Event	Placebo (n=315)	5 mg/day (n=311)	10 mg/day (n=315)	10 mg/day (n=269)
Nausea	5%	5%	19%	5%
Diarrhea	5%	8%	15%	9%
Insomnia	6%	6%	14%	5%
Fatigue	3%	4%	8%	3%
Vomiting	3%	3%	8%	5%
Muscle cramps	2%	6%	8%	3%
Anorexia	2%	3%	7%	3%

Adverse Events Reported in Controlled Trials The events cited reflect experience gained under closely monitored conditions of clinical trials in a highly selected patient population. In actual clinical practice or in other clinical trials, these frequency estimates may not apply, as the conditions of use, reporting behavior, and the kinds of patients treated may differ. Table 3 lists treatment emergent signs and symptoms that were reported in at least 2% of patients in placebo-controlled trials who received ARICEPT® and for which the rate of occurrence was greater for ARICEPT® assigned than placebo assigned patients. In general, adverse events occurred more frequently in female patients and with advancing age.

Table 3. Adverse Events Reported in Controlled Clinical Trials in at Least 2% of Patients Receiving ARICEPT® (donepezil HCl) and at a Higher Frequency than Placebo-treated Patients

Body System/Adverse Event	Placebo (n=355)	ARICEPT® (n=747)
Percent of Patients with any Adverse Event	72	74
Body as a Whole		
Headache	9	10
Pain, various locations	8	9
Accident	6	7
Fatigue	3	5
Cardiovascular System		
Syncope	1	2
Digestive System		
Nausea	6	11
Diarrhea	5	9
Vomiting	3	5
Anorexia	2	4
Hemic and Lymphatic System		
Ecchymosis	3	4
Metabolic and Nutritional Systems		
Weight Decrease	1	3
Musculoskeletal System		
Muscle Cramps	2	6
Arthritis	1	2
Nervous System		
Insomnia	6	9
Dizziness	6	8
Depression	<1	3
Abnormal Dreams	0	3
Somnolence	<1	2
Urogenital System		
Frequent Urination	1	2

Other Adverse Events Observed During Clinical Trials ARICEPT® has been administered to over 1700 individuals during clinical trials worldwide. Approximately 1200 of these patients have been treated for at least 3 months and more than 1000 patients have been treated for at least 6 months. Controlled and uncontrolled trials in the United States included approximately 900 patients. In regards to the highest dose of 10 mg/day, this population includes 650 patients treated for 3 months, 475 patients treated for 6 months and 116 patients treated for over 1 year. The range of patient exposure is from 1 to 1214 days. Treatment emergent signs and symptoms that occurred during 3 controlled clinical trials and two open-label trials in the United States were recorded as adverse events by the clinical investigators using terminology of their own choosing. To provide an overall estimate of the proportion of individuals having similar types of events, the events were grouped into a smaller number of standardized categories using a modified COSTART dictionary and event frequencies were calculated across all studies. These categories are used in the listing below. The frequencies represent the proportion of 900 patients from these trials who experienced that event while receiving ARICEPT®. All adverse events occurring at least twice are included, except for those already listed in Tables 2 or 3, COSTART terms too general to be informative, or events less likely to be drug caused. Events are classified by body system and listed using the following definitions: *frequent adverse events* — those occurring in at least 1/100 patients; *infrequent adverse events* — those occurring in 1/100 to 1/1000 patients. These adverse events are not necessarily related to ARICEPT® treatment and in most cases were observed at a similar frequency in placebo-treated patients in the controlled studies. No important additional adverse events were seen in studies conducted outside the United States. **Body as a Whole:** *Frequent:* influenza, chest pain, toothache. *Infrequent:* fever, edema face, pericorbital edema, hernia hiatal, abscess, cellulitis, chills, generalized coldness, head fullness, listlessness. **Cardiovascular System:** *Frequent:* hypertension, vasodilation, atrial fibrillation, hot flashes, hypotension. *Infrequent:* angina pectoris, postural hypotension, myocardial infarction, AV block (first degree), congestive heart failure, arteritis, bradycardia, peripheral vascular disease, supraventricular tachycardia, deep vein thrombosis. **Digestive System:** *Frequent:* fecal incontinence, gastrointestinal bleeding, bloating, epigastric pain; *Infrequent:* eructation, gingivitis, increased appetite, flatulence, periodontal abscess, cholelithiasis, diverticulitis, drooling, dry mouth, fever sore, gastritis, melena colon, tongue edema, epigastric distress, gastroenteritis, increased transaminases, hemorrhoids, ileus, increased thirst, jaundice, melena, polydipsia, duodenal ulcer, stomach ulcer. **Endocrine System:** *Infrequent:* diabetes mellitus, goiter. **Hemic and Lymphatic System:** *Infrequent:* anemia, thrombocythemia, thrombocytopenia, eosinophilia, erythrocytopenia. **Metabolic and Nutritional Disorders:** *Frequent:* dehydration. *Infrequent:* gout, hypokalemia, increased creatine kinase, hyperglycemia, weight increase, increased lactate dehydrogenase. **Musculoskeletal System:** *Frequent:* bone fracture. *Infrequent:* muscle weakness, muscle fasciculation. **Nervous System:** *Frequent:* delusions, tremor, irritability, paresthesia, aggression, vertigo, ataxia, increased libido, restlessness, abnormal crying, nervousness, aphasia. *Infrequent:* cerebrovascular accident, intracranial hemorrhage, transient ischemic attack, emotional lability, neuralgia, coldness (localized), muscle spasm, dysphonia, gait abnormality, hypertonia, hypokinesia, neurodermatitis, numbness (localized), paranoia, dysarthria, dysphasia, hostility, decreased libido, melancholia, emotional withdrawal, nystagmus, pacing. **Respiratory System:** *Frequent:* dyspnea, sore throat, bronchitis; *Infrequent:* epistaxis, post nasal drip, pneumonia, hyperventilation, pulmonary congestion, wheezing, hypoxia, pharyngitis, pleurisy, pulmonary collapse, sleep apnea, snoring. **Skin and Appendages:** *Frequent:* pruritus, rash, urticaria; *Infrequent:* dermatitis, erythema, skin discoloration, hyperkeratosis, alopecia, fungal dermatitis, herpes zoster, hirsutism, night sweats, skin ulcer. **Special Senses:** *Frequent:* cataract, eye irritation, vision blurred. *Infrequent:* dry eyes, otitis media, earache, tinnitus, blepharitis, decreased hearing, retinal hemorrhage, otitis externa, otitis media, bad taste, eye hemorrhage, ear buzzing, motion sickness, spots before eyes. **Urogenital System:** *Frequent:* urinary incontinence, hematuria; *Infrequent:* dysuria, hematuria, urinary urgency, metrorrhagia, cystitis, enuresis, prostate hypertrophy, urinary tract infection, inability to empty bladder, breast fibroadenosis, fibrocystic breast, mastitis, pyuria, renal calculus. **Postintroduction Reports** Voluntary reports of adverse events temporally associated with ARICEPT® that have been received since market introduction that are not listed above, and that there is inadequate data to determine the causal relationship with the drug include the following: abdominal pain, agitation, cholecystitis, confusion, convulsions, hallucinations, heart block (all types), hemolytic anemia, hepatitis, hyponatremia, pancreatitis and rash. **OVERDOSAGE Because strategies for the management of overdose are continually evolving, it is advisable to contact a Poison Control Center to determine the latest recommendations for the management of an overdose of any drug.** As in any case of overdose, general supportive measures should be utilized. Overdosage with cholinesterase inhibitors can result in cholinergic crisis characterized by severe nausea, vomiting, salivation, sweating, bradycardia, hypotension, respiratory depression, collapse and convulsions. Increasing muscle weakness is a possibility and may result in death if respiratory muscles are involved. Tertiary anticholinergics such as atropine may be used as an antidote for ARICEPT® overdosage. Intravenous atropine sulfate titrated to effect is recommended: an initial dose of 1.0 to 2.0 mg IV with subsequent dosages based upon clinical response. Atypical responses in blood pressure and heart rate have been reported with other cholinomimetics when co-administered with quaternary anticholinergics such as glycopyrrolate. It is not known whether ARICEPT® and/or its metabolites can be removed by dialysis (hemodialysis, peritoneal dialysis, or hemoperfusion). Dose related signs of toxicity in animals included reduced spontaneous movement, prone position, staggering gait, clonic convulsions, depressed respiration, salivation, miosis, tremors, fasciculation and lower body surface temperature.

Revised September 1999

Eisai Inc.
Teaneck, NJ 07666

Pfizer U.S. Pharmaceuticals
New York, NY 10017

© 2000, Eisai Inc. and Pfizer Inc

AROUND THE MALL & BEYOND

The Talking Drums

A SMITHSONIAN EXHIBITION OF PERCUSSION INSTRUMENTS CELEBRATES THE MUSICAL ROOTS OF THE CARIBBEAN

BY MICHAEL KERNAN

Uniquely carved and decorated, these handcrafted drums link the music and cultures of Africa and the Caribbean.

I DIDN'T KNOW HOW MUCH I DIDN'T KNOW ABOUT drums. There are drums that talk, that can imitate speech. There are drums grouped in families for the purpose of talking to each other. Tapping a drum with your fingers produces a sound different from playing it with your palms, or striking it in the center, on the rim or on its sides. There are even drums with flexible flanks that you squeeze under your arm to change their tone.

Not to mention maracas, triangles, gourds, bells, pairs of hardwood sticks (male and female) called claves, thumb pianos and other items that you hit or shake to make people dance and gods listen.

There must be 150 drums and other percussion instruments in the wonderful new exhibition at the Smithsonian's Arts & Industries Building, in the space where for years we saw all those gigantic 19th-century machines. Called "Ritmos de Identidad" (Rhythms of Identity), the show is organized by the Smithsonian Center for Latino Initiatives, a department created in 1998 to increase and enhance the representation of Latino culture in the Institution's museums and educational programs.

The exhibition features items from the Dr. and Mrs. Joseph H. Howard Family Collection, a treasure trove of handmade instruments amassed by an oral surgeon and his family, and pays tribute to Fernando Ortiz, a scholar of Caribbean culture.

It was Ortiz, a Cuban anthropologist and a pioneer in Afro-Cuban studies, who brought the African origins of Cuban music to the world's attention with his 30 books and his lifetime of work for social justice. And it was Joseph Howard, an ally whom Ortiz never met, who collected some 700 percussion instruments from Asia, the Pacific, Africa, Europe and the Americas.

The exhibition, which has text and videos in English and Spanish, explores the transformation of African music once it arrived in the Caribbean and the United States, including liturgical African rhythms used to invoke deities, Caribbean drum calls to freedom, early Latin jazz and Top 40 Latin pop. The show is on view here through August 1, then moves to the Historical Museum of Southern Florida in Miami, where it will run from September 8 through January 21, 2001.

What caught my eye were some *batá* drums from the Yoruba people of Nigeria. These double-headed, hourglass-

shaped drums are often played in ensembles of three for sacred ceremonies. Carved laboriously from a single piece of wood and topped with goatskin, they are equipped with leather cords that can be used to adjust the tones. Bells and a circle of beeswax on the drumheads produce even more musical variation.

"They are like people," explained Michael Atwood Mason, an anthropologist at the Smithsonian's National Museum of Natural History who helped curate the show. "The largest of the three is the *iyá* or the mother drum, the middle one is the *itótele*, and the baby is the *okónkolo*. They communicate with each other through successive interlocking rhythms, a sort of polyrhythmic call and response.

"Batá drums imitate the tonal language of Yoruba," Mason continued. "Any Yoruba syllable has one of three tones, in a fixed relationship with each other, and the batá imitates them. In ritual drumming, the drums are played for the *orishas*, the Yoruba gods. It's believed the drums themselves are praising the orishas."

Praise poems, Mason told me, are a major part of West African culture. "By praising something, extolling its attributes over and over, you gain influence with it. It can be a god or a king or your grandfather. In West Africa, everyone has praise poems associated with them, but in Cuba the praises are reserved for the gods. And when you play the tones on the drums, people recognize the being or deity being praised."

He sang for me a praise poem for Oshún, the orisha of the river. It was in a Yoruba dialect that's spoken in Cuba. Lilting and cadenced, the poem reminded me of the patter of gentle rain. The belief was that the goddess would become more engaged in the lives of those who praise her.

I went through the exhibition with Refugio Rochin, director of the Center for Latino Initiatives, and Miguel Bretos, its senior scholar and associate director.

"We are developing a five-year program on Latin music showing its diversity and contributions to American culture," Rochin said. "This exhibition highlights the Afro-Caribbean contributions, and it is symbolic of what can be expected in the future."

Bretos, who was senior curator for "Ritmos," recalled the challenge of getting the show up.

"There was a small window of opportunity to use the space, and it was a difficult space," he told me. "We had to put in our own floor, wiring, everything—had to muffle the sound because the place echoes so."

It's an ingenious arrangement, a sort of chambered nautilus that you wander through, encountering the many aspects of drums. Though the exhibition is walled in, there are several windows that invite passersby to peer in. Sounds of rhythmic drumming permeate the setting, thanks to tapes and videos.

Other videos narrated by the daughters of Ortiz and Howard explain both men's role in preserving the Afro-Cuban music connection, but the women were also on hand at the opening, sharing memories of their fathers.

"I fell asleep to the sound of those drums," Victoria Howard said, staring at a large photograph of her father playing congas. "Drummers would come to the house every weekend for jam sessions, and the sounds drifted up the stairs. The rhythm of the drums became a lullaby.

"My father felt it was rhythm that was universal," she commented in the video. "As a family we spent years participating in what my father called his 'adolescent hangover.' As a boy growing up in Venezuela until he was about 7 years old, he was obsessed with rhythms and drumming and hanging out on the streets with his buddies playing drums."

Howard refers to her family as "African-American with a multicultural lineage." Her father was born in Venezuela, and was descended from African-Americans, East Indians and Europeans, and her mother was of similar heritage and part Native American. Collecting drums from around the world became a way of exploring their diverse ethnic roots, Howard said.

"My brother and I didn't have a choice. We were involved in the collection whether we wanted to be or not. My father would take my brother and me into the drum room and point at all of the drums and say 'you are the fruit of the cross of cultures and of the pride they bear. You are children of the world's culture; you are from everywhere, like the drums.'"

The whole family worked on the collection,

Traditional drums reflect their makers' artistic whims (left to right): A Venezuelan *furruco* bears a handwritten note; a rural scene adorns a Cuban *quinto*; and a *tambú* from the Dominican Republic is made from a barrel.

ALL: PETER OWEN/VICTORIA R. HOWARD (OWNER), DR. AND MRS. JOSEPH H. HOWARD FAMILY COLLECTION

Ms. Colegate likes to keep her students in the dark.

Deep within Ms. Colegate's classroom lies a secret cave. A cave filled with bats, spiders, scorpions and other denizens of the dark.

Two by two, second graders are sent in to explore its dank recesses. Once inside, they must record the temperature, note various sights and sounds, and conduct experiments.

And though this creepy cavern is only a blanket-covered tent, the plants and animals merely pictures, and its pungent aroma made by moldy cheese, to Ms. Colegate's class they are very real, very exciting, and very educational. Second graders may enter this cave, but "spelunkers" psyched about scientific exploration emerge.

That's why State Farm is pleased to present Ms. Carol Colegate with our Good Neighbor Award® and to present $5,000 to her school, Morgan Elementary, in Hamilton, Ohio. She makes the dark an enlightening place.

Good Neighbor Award®

STATE FARM INSURANCE COMPANIES
Home Offices: Bloomington, Illinois
statefarm.com™

The Good Neighbor Award was developed in cooperation with The National Science Teachers Association.

The exhibition is proof that music unites people separated by language and oceans and time.

helping with the documentation, joining Joseph Howard on trips all over the world. His wife, Tommye Berry, specialized in African art. Often Howard's stamp collection, part of which is in the exhibition, brought exotic instruments to his attention.

In 1960 Dr. Howard bought some batá drums made by Trinidad Torregrosa, a famous Havana drum maker. Torregrosa knew Ortiz, and the vital connection was made. Ortiz became another source for Howard in the classification and management of his growing assortment of drums.

Surveying a desk with Ortiz's papers, glasses, books, awards and a tiny thumb piano, María Fernanda Ortiz Herrera talked about her father's love of Cuba and his respect for other people's ideas.

He founded the Hispano-Cuban Cultural Society in the 1920s. "Everybody was welcome, from the Communists to the Franciscans to the Jesuits," she said.

Exploring Cuba's diverse population, he concluded that there are no races, only ethnic groups, and that it is through cultures that human beings find their true identity. In his book *Cuban Counterpoint: Tobacco and Sugar,* he coined the word "transculturation," a process that is clearly demonstrated by this exhibition, with its proof that music unites people separated by language and oceans and time.

Field research in Cuban culture led to African studies. In the '50s, Ortiz began researching African dance, music and theater. "If it had not been for him, much of the authenticity would be lost," Ortiz Herrera said.

Not far from the desk display is a section on drum history. Batá drums came to Cuba in the early 1800s when a Yoruba master arrived on the island, as the wall text says, "in bondage."

"Approximately a million slaves were brought to Cuba," Bretos said. "They came from West Africa, brought by the Spanish, British, Dutch and Portuguese to work the sugar plantations. The slave trade officially ended in 1820, but slavery itself continued until 1886. That's pretty late."

Many Yorubas wound up in the Havana and Matanzas districts of Cuba, but the drumming tradition quickly spread all over the island along with the technique of making batás. The instruments, however, were often prohibited or restricted by authorities because drums could be used to spread a message of defiance among slaves as well as to petition the gods.

Bretos introduced me to some other drums: tall *atumpans* and wide-bellied, pedestaled *fotomfrons* from Ghana, the cone-shaped *turu* from Nigeria and the Jamaican signal drum. Another display featured a painted serpentine guiro from Suriname whose scored side delivers a washboard sound, an iron music-maker that must have been a hoe at one time, and a jackass's jawbone. This last-mentioned, which is painted red and green with teeth intact, makes an "incredible" sound, the curator told me.

There is a *balafon*, shaped like a chaise longue or an Arctic dogsled; it's made from hefty lengths of wood with rows of large gourds underneath to amplify the sound. There is even a large thumb piano the size of a suitcase—with handles, too.

"The idea is," Bretos said, "that the music goes on. Here at the end of the exhibit we have the modern drums. Some are from Howard's collection, some were gifts. We're beginning to do some recitals and poetry readings here. The glass walls are here for better security, but there are also drums you can actually play as you go along."

A clutch of contemporary drums mirrors their traditional counterparts across the aisle. The fiberglass and plastic instruments are more tunable and durable than the handmade ones, but "the sounds are very similar," said Marvette Pérez, a curator at the National Museum of American History who worked on the show. The traditional drums "have been reproduced and are played in many different kinds of music—Latin, rock and roll, even jazz. It's part of the transculturation."

Bretos pointed to a set of modern congas bearing the name Poncho Sanchez in black script. "He played these and signed them when he was at the Smithsonian last month," Bretos said.

"He's Mexican-American, but he plays Afro-Caribbean music. That's a crossover right there."

He spoke with pride and delight, adding, "This is our first exhibit. We need some kind of place where these things can happen."

It looks like he's found it.

Collector Joseph Howard acquired this *batá* ensemble in 1960 from the renowned Cuban drum maker Trinidad Torregrosa.

Out in the wild, who can you trust?

PC Magazine
Maptech Terrain Navigator. "Top 100 CDs" 1999

Field & Stream Magazine
Maptech Terrain Navigator. "Best of the Best" 1998

Popular Science Magazine
Maptech National Park Digital Guide. "The Best of What's New" 1998

PC Magazine
Maptech National Park Digital Guide. "Top 100 CDs" 1999

Men's Journal Magazine
Maptech Appalachian Trail Digital Guide. "Gear of the Year" 1999

Sports Afield Magazine
Maptech Take a Hike® Series. "Editor's Choice for Outstanding New Product" 1998

Wherever you're heading – for hiking, hunting, cross-country skiing, or anything else – Maptech Digital Maps make your planning easier, quicker, and more fun.

The maps are official U.S. Geological Survey "topos," reproduced in sharper, clearer detail than anybody else's. We use up to 256 colors, not just 11. With elevation profiles, databases full of useful trail information, and software that makes it all super-easy to use.

And obviously, it's not just us who think so.

Only $29 – $99 per CD.

MAPTECH®

The leader in digital mapping

1-800-627-7236

Try it free – view, e-mail or print out a map! www.maptech.com

Art Recalls a Forgotten War

SMITHSONIAN

HIGHLIGHTS

IT IS FEBRUARY 9, 1904. SEVERAL ships of the formidable Imperial Russian Navy lie damaged in the harbor at Port Arthur (now Lushun), at the tip of China's Liaotung Peninsula. The battle had begun the night before, while the Russians slept. Ten Japanese ships delivered a sensational surprise attack, to start the Russo-Japanese War, and the balance of world power was suddenly and forever altered. "A Well-Watched War: Images from the Russo-Japanese Front, 1904-1905" opens June 11 at the Arthur M. Sackler Gallery and features 38 Japanese woodblock prints, most in triptych, that detail this conflict. Also in the exhibition are illustrations that appeared in European news magazines chronicling the war to the rest of the world. The show makes for an interesting contrast of the Japanese and the Western perspectives of the battles. In the triptych print above, Commander Yamanaka, chief gunnery officer on the battleship *Fuji*, raises his arm as he commands his men. His earlier mission to barricade the harbor has made him a hero. The artist, Migita Toshihide, depicts him just before his death on February 25 when the *Fuji* was hit twice by Russian guns. —*Beth Py-Lieberman*

YES YOU CAN.

With some of the most advanced features ever offered in a sport sedan, the S-TYPE is as brainy as it is beautiful. But with a starting price of just $43,395*, there's no reason to feel intimidated by it at all. For a free S-TYPE video, send in the attached card, visit www.s-typevideo.com/17 or call 1 877 S-TYPE-17.

JAGUAR

THE ART *of* PERFORMANCE

*2000 S-TYPE V6 MSRP $43,395. Tax, title and license fees extra. ©2000 Jaguar Cars.

www.s-typevideo.com/17

SMITHSONIAN HIGHLIGHTS

Piano Grand

A CELEBRATION FROM SMITHSONIAN PRODUCTIONS

"It alone is the only instrument that can provide the power and finesse, and the balance and the voicing of a full orchestra," says jazz pianist Marcus Roberts in "PIANO GRAND! A Smithsonian Celebration." The show airs on PBS stations nationwide this month. Hosted by "Piano Man" Billy Joel, the show also features the Smithsonian Chamber Orchestra and performances by Roberts, jazz pianist Dave Brubeck (below), the "great ball of fire" Jerry Lee Lewis and others. Even the Beethoven-playing *Peanuts* character Shroeder and his sidekick, Lucy, make cameo appearances in this, a celebration of the 300th anniversary of the piano's invention. "No other instrument has reached into people's lives in as many ways as the piano," says Paul Johnson, director of Smithsonian Productions. The 90-minute special, filmed in HDTV, is a companion piece to the "PIANO 300" exhibition currently on view in the S. Dillon Ripley Center.

Dave Brubeck performs in a Smithsonian production airing this month on PBS.

Folklife Festival

ON THE NATIONAL MALL

This year's Folklife Festival features cultural traditions from the regions along the 2,000-mile Rio Grande, Washington, D.C. and Tibet. Opening June 23 and running through June 27, and then again from June 30 through July 4, the festival will include go-go music, and demonstrations of cowboy arts and the making of sand mandalas. Evening entertainment includes tributes to songwriters Peggy Seeger, Malvina Reynolds and Woody Guthrie.

SMITHSONIAN Website

WWW.SMITHSONIANMAG.SI.EDU

At the Magazine's homepage, click on "Events" to go to the calendar and view on-line versions of Smithsonian exhibitions and visit the museums' Websites. This month our on-line gallery features selections from "A Well-Watched War: Images from the Russo-Japanese Front, 1904-1905" (p. 32).

Exhibitions and Events

TREASURES TO GO

During renovation of the Smithsonian American Art Museum's gallery space, some 500 artworks will tour to more than 70 museums across the country. Opening this month are exhibitions in East Hampton, New York; San Antonio, Texas; Wilmington, Delaware; and Chattanooga and Nashville, Tennessee. Call 202-357-2247 or click on "Treasures to Go" at www.americanart.si.edu.

ART NIGHT ON THE MALL

African Art, the Hirshhorn, the Sackler, the Freer and the International Gallery will be open until 8 P.M. on Thursdays, June 1 through August 31.

NATIONAL MUSEUM OF AFRICAN ART

Audible Artworks: Selected African Musical Instruments (June 25 through April 8, 2001) Music from the time of the Egyptian pharaohs to that of today's urban nightlife is an integral part of African life. Audio stations provide instrument samplings.

Transatlantic Dialogue: Contemporary Art In and Out of Africa (through September 3) Artworks that represent a cultural dialogue and exchange between eight contemporary African artists and eight African-American artists and their shared influences and experiences.

INTERNATIONAL GALLERY, S. DILLON RIPLEY CENTER

PIANO 300: Celebrating Three Centuries of People and Pianos (through March 4, 2001) Features a variety of piano designs, dating back to c. 1700.

ARTS AND INDUSTRIES BUILDING

Ritmos de Identidad: Fernando Ortiz's Legacy & the Howard Family Collection of Percussion Instruments (through August 1) A bilingual exhibition featuring 150 unique percussion instruments.

Reflections in Black: A History of Black Photographers, 1840 to the Present (through July 30) Showcases more than 300 images.

NATIONAL MUSEUM OF AMERICAN HISTORY

An American Diary (June 10 through September 4) A series of small paintings by Roger Shimomura inspired by diary entries by his grandmother during World War II.

Fast Attacks and Boomers: Submarines in the Cold War Learn about submarines through graphics, artifacts and hands-on interactives.

NATIONAL MUSEUM OF NATURAL HISTORY

Selections from Forces of Change: A New View of Nature (June 8 through October 9) This exhibition of 28 large-format photographs coincides with the release

BIDER ANTIQUES
250 Sutton
[illegible] MI 48067

Total $367.75

The new GM card rewards you 5¢ on every purchase, making it the fastest way to save toward the GM car or truck of your dreams.

Charge toward new cars and trucks from Chevrolet, Pontiac, Oldsmobile, Buick, Cadillac and GMC. You can even take advantage of great new travel, entertainment and retail specials. The choice is yours.

The new GM card.
No Annual Fee. 5¢ Earnings.
Call 1-800-5GM-CARD.
www.gmcard.com

THE NEW

What are you charging toward?℠

©2000 General Motors Corporation. The GM Card is issued and administered by [illegible] pursuant to a license from General Motors Corporation.

Ed Ruscha's bold paintings go on view at the Hirshhorn this month.

of a new book of the same title that examines the geological, environmental and cultural processes that shape our world.
Vikings: The North Atlantic Saga (through August 13) New archaeological finds that redefine the year 1000 period.
African Voices Examines the diversity and global influence of Africa's peoples.

NATIONAL AIR AND SPACE MUSEUM

Looping the Loop: Posters of Early Flight (through July 9) Posters on themes of early flight, from the Allen Airways Flying Museum in El Cajon, California.
R. G. Smith: The "Old Master" of the Sky (through September 5) Among the artists who have recorded the history of flight on canvas, Smith is regarded as the American master.

HIRSHHORN MUSEUM AND SCULPTURE GARDEN

Dalí's Optical Illusions (through June 18) Some 65 rarely seen works by the flamboyant artist that center on his exploration of optics and perception. For information, call 202-786-2122.
Ed Ruscha (June 29 through September 17) Beginning with bold, colorful 1960s paintings depicting the typography of signs and logos, such as *Standard Station, Amarillo, Texas* (above), this exhibition features 75 works by the Los Angeles artist, including several of his recent canvases.

RENWICK GALLERY, SMITHSONIAN AMERICAN ART MUSEUM

The Art of John Cederquist: Reality of Illusion (through August 20) Thirteen playful, multidimensional works.
The Renwick Invitational: Five Women in Craft (through August 20) Works by a ceramist, a fiber artist, a basket maker, a jewelry designer and a metalsmith.

ARTHUR M. SACKLER GALLERY

The Heroic Past: The Persian Book of Kings (June 4 through October 29) Poet Firdawsi composed the Iranian national epic "Shahnama" in 1010 to recount the history of the Persian kings. Paintings, ceramics, coins and manuscript illustrations reveal the historical figures in the legendary poem.
Music in the Age of Confucius (through September 17) The earliest and most extensive surviving group of musical instruments from the ancient world.

FREER GALLERY OF ART

Brushing the Past: Later Chinese Calligraphy from the Gift of Robert Hatfield Ellsworth (through January 2, 2001) A selection of recently donated late Chinese calligraphy.
The Dragon's Moan (through October 1) Works celebrating the *qin*, or zither.

GEORGE GUSTAV HEYE CENTER, NATIONAL MUSEUM OF THE AMERICAN INDIAN [NEW YORK CITY]

Reservation X: The Power of Place (through August 20) Native artists from Canada and the United States explore Native community life and mainstream society.

COOPER-HEWITT, NATIONAL DESIGN MUSEUM [NEW YORK CITY]

National Design Triennial: Design Culture Now (through August 6)

CLOSED FOR RENOVATIONS

The Smithsonian American Art Museum and the National Portrait Gallery are closed for the next three years. The Anacostia Museum Gallery reopens next spring.

Planning a Smithsonian Visit?

THE CASTLE—INFORMATION CENTER

The Associates' Reception Desk in the Castle's Smithsonian Information Center is open 9 A.M.-4 P.M. daily. Information on exhibitions, activities and dining is available there. Learn what's new at the Smithsonian and about other area attractions—with brochures, videos, touch screens and electronic maps. Ask about Sunday morning Castle tours for members. Smithsonian museums are generally open 10 A.M.-5:30 P.M. daily, except December 25. To receive a free Associates' planning packet, write to Smithsonian Information, Smithsonian Institution, Washington, D.C. 20560-0010, or send your request via e-mail to info@info.si.edu, or call 202-357-2700 (voice) or 202-357-1729 (TTY), 9 A.M.-5 P.M., Monday-Friday; 10 A.M.-4 P.M., Saturday-Sunday. Note: Parking on the Mall is limited; Metrorail is convenient to most museums.

Have You Herd...

About the World's Finest Livestock Investment?

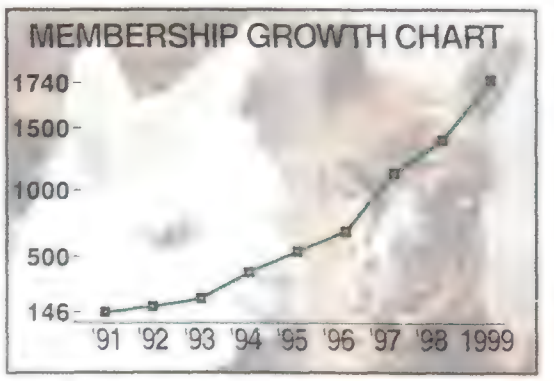
ALPACAS... THE ALTERNATIVE LIVESTOCK THAT MORE & MORE PEOPLE ARE TURNING TO FOR LONG TERM FINANCIAL REWARDS

The Huggable Investment

The joy, ease of care and profitability of raising alpacas has allowed people to leave their corporate jobs to become full-time breeders, giving them more time with their families. This is made possible since alpacas can be **raised on relatively small acreage.** There are also plenty of family-oriented alpaca events around the country that are fun for families to take part in as well.

Alpacas have brought impressive financial returns to families all across America, but it's the fun and hands on nature of this lifestyle that has really captivated people searching for a simpler and more rewarding way of life.

Alpacas are depreciable as livestock and subject to capital gains treatment. They first came to this country from South America less than twenty years ago. They are beautiful, gentle and easy to care for and have long, productive breeding lives that can create great returns for their owners.



IMPRESSIVE GROWTH IN AOBA MEMBERSHIP SINCE 1991 REFLECTS THE TREND OF THE ALPACA AS AN INVESTMENT AND LIFESTYLE ALTERNATIVE

Alpacas are required to have their pedigreed lineage confirmed and registered. **Registration is a major factor in preserving the alpaca's value.**

Careful breeding practices, the scarcity of this unique livestock and the fact that alpacas normally have only one baby(cria) per year are key factors in preserving the future value of alpacas in the marketplace.

Alpacas are currently most profitable for breeding. But in the future their fleece, which far exceeds the quality of traditional wool with regards to warmth, durability and beauty, will eventually position the alpaca firmly in the midst of a fiber industry that holds boundless potential.

For more in-depth information about alpacas call the Alpaca Owners and Breeders Association (AOBA) at 1-800-213-9522

ALPACA • OWNERS • AND • BREEDERS
ALPACAS
ASSOCIATION

www.AlpacaInfo.com

Charting the Terrain of TOUCH

MANDAYAM SRINIVASAN'S LABORATORY AT THE Massachusetts Institute of Technology studies the human hand. Srinivasan tells me when I visit that some people, blind and deaf since toddlerhood, have learned to "listen" by resting a hand on a speaker's throat and cheek. One such blind-deaf man "listened" to Srinivasan. "I was flabbergasted," Srinivasan says, his intonations only hinting at his native Bangalore. "He asked if I was Indian!"

He holds up his right hand, so I can marvel at so sensitive an instrument. He waggles his fingers. He curls them forward, first one row of knuckles, then the next, forming a fist. He twists the fist clockwise, counterclockwise. "I think about it like an engineer," he observes. "This is a system—how does this system work?"

To answer that question, he created MIT's Laboratory for Human and Machine Haptics—"haptics" is the Greek-derived word for studies of the properties of touch, including particularly the hand. Srinivasan's laboratory is nicknamed the Touch Lab. Researchers here use potent new ultrasound devices to peer into their own hands' skin, attempting to examine buried touch sensors. They build machines that mete out precise pricks and pressures and buzzes to fingers, usually their own, to measure the tiniest sensations hands can discern. And these scientists are investigating the physical responses that underlie the functioning of our fingers and skin. Exploiting their data, they have helped create devices that let you "feel" objects that exist only digitally. And then they use those devices to further probe the mysteries of our hands.

BY RICHARD WOLKOMIR

AT MIT'S LABORATORY FOR HUMAN AND MACHINE HAPTICS, RESEARCHERS ARE PROBING THE INNER WORKINGS OF OUR HANDS

Robot hands that are sensitive enough to pick up pins could emerge from this lab. So could bionic hands for amputees. Surgeons could practice new scalpel procedures by harmlessly slicing air. Touch Lab research could lead to new art forms. It will certainly spawn weird games.

"Go ahead, hold that stylus like a pen, use it to explore," researcher Chih-Hao Ho tells me gleefully. We sit in front of a turned-off computer screen. I am holding a stylus resembling a dentist's drill on its long, flexible arm. "It's like a blindfolded person who is going to use a stick in order to explore the world," Ho says, grinning with anticipation.

I move the stylus and sense that it rests on a plane, like the top of an invisible desk. When I push down, it resists, although it moves freely in all other directions. As I push the stylus across the plane, however, I feel it bump something.

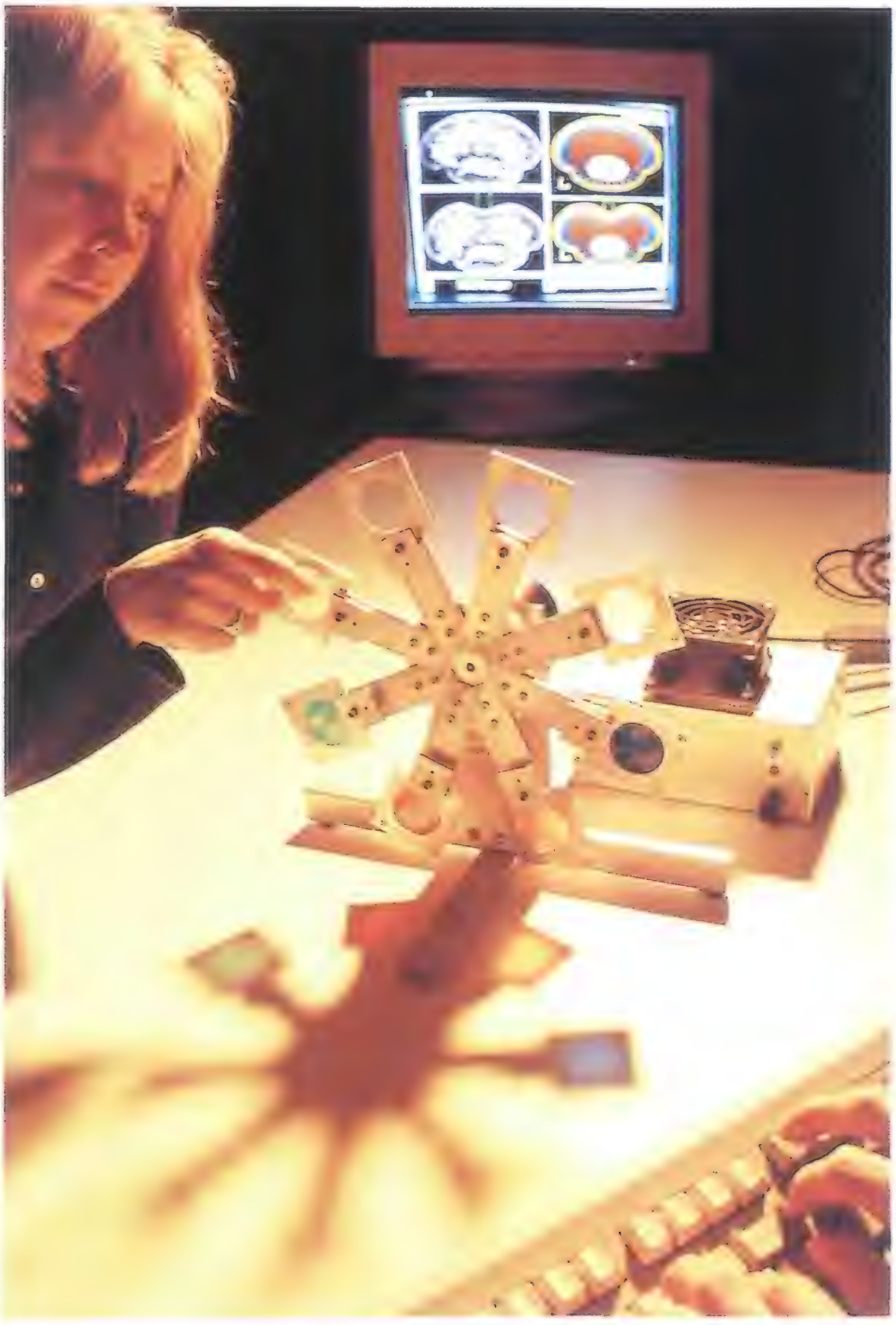
"What is that?" Ho asks.

PHOTOGRAPHS BY RICHARD SCHULTZ

Mandayam Srinivasan (opposite), creator of MIT's "Touch Lab," has based his research on the assumption that the hand (seen here as an x-ray image) "really ends at the brain."

The lab uses its findings to invest virtual environments with the sense of touch.

"It feels like a dome set into the plane," I say. He turns on the computer screen, and I see the "virtual reality" world in which I have been moving my stylus. "Virtual" is the computer scientist's term for objects that exist only inside a computer. And, sure enough, using just my sense of touch, I have been exploring a plane with an imbedded hemisphere, "feeling" objects that exist only as computer code. When I try to push the stylus through the plane or the dome, the computer activates tiny motors, exerting a counterforce against my hand, simulating the resistance of a solid surface. It feels uncannily real.



To investigate the extraordinary sensitivity of our finger pads, scientists use a rotating, multiarmed device to present varying surfaces to a research subject. The computer screen displays MRI images of the person's finger-pad cross section.

Ho puts a sphere on the screen. I move the stylus-controlled screen cursor all around it, and through the stylus I "feel" its roundness. He puts a virtual button on the computer screen and then instructs me to push it with the stylus tip. It feels just like pushing a real button. "See?" Ho inquires. "With this, you could control your computer in 3-D!"

Virtual reality—or, as the researchers prefer to call it, "virtual environment"—is hot in high-tech circles. NASA, for instance, uses virtual environments to train astronauts in such skills as firing their backpack thrusters to return to the shuttle if their tether should disconnect. Usually, you enter such virtual environments by donning goggles that show you images, plus earphones for sound and a wired-up glove that tells the computer where you are pointing or grasping. But Srinivasan's lab is using its findings about how the hand works to invest virtual environments with something new, the sense of touch. And he believes this use of haptic research is about to "explode."

On the computer screen appears a ball with a rough-looking surface: it feels like sandpaper under the stylus. Here is a doughnut with a surface that feels like corduroy. "Look," says Ho. "Lungs! Liver! Stomach! Intestines! Kidneys!" I poke the virtual organs with my stylus and feel the tissues give and then resist as I push deeper. On the screen, under the stylus-controlled cursor, I see the organs dimple where I poke, and watch them bobble in the virtual torso.

Ho and I play a game, each using a

Assuming his role as "surgeon," graduate student Jung Kim takes up virtual instruments to perform virtual surgery on a virtual organ, the gallbladder (center computer screen). This device is being developed to train surgeons in laparoscopic procedures.

stylus: we must cooperate to tilt a virtual table with our styluses, so that a ball rolls down the incline, bumping into a series of prongs. I "feel" the table's bulk under my stylus, feel it tip, feel when my stylus is working against Ho's. "So, two people could work together in one virtual environment," he notes. He cites a hypothetical example: an engineer in Tokyo, say, is working on a new car with a designer in Detroit. Both of the collaborators could "feel" the contours of the new model.

We play another game: a doughnut-shaped virtual ring rests upon a wire running through the hole. Using our styluses, we must cooperate to lift the ring and slide it along the wire. "We use this to try to understand how humans can interact through touch in a virtual environment," Ho explains. I suggest this could be a cool computer game. "Someday," Ho concurs. "Right now, it's an *expensive* game!"

Games will come. For now, the laboratory has more serious aims. Ho shows me a box draped with a green operating room cloth, with what look like two scissors handles poking out the top. Mandayam Srinivasan, who has joined us, says wryly: "This is a laparoscopic surgery patient." He tells me the laparoscopic instruments sticking out of the cloth are for making tiny, virtual incisions. A screen shows the "patient's" liver, with the stomach below. When a surgeon uses the instruments to practice surgery on the liver, he "feels" the liver's tissues press against his knives. "We invited a surgeon to try it, and he said it was pretty good, but the image on the screen is not yet realistic and we have to improve the 'feel' of the tissues," says Ho. "So it won't be a usable tool soon, but we're making progress!"

Progress grows from the lab's new gadgets, which perform such tests as applying precise pressures to fingers or seeing how hands interact with

Wielding a computer-controlled stylus, another graduate student, Thao Dang, employs a sense of virtual touch to trace the outlines of a virtual rectangle, a shape that actually exists only as computer code.

virtual environments. Gadgets aside, however, it is surprising that Mandayam Srinivasan studies the human hand, because he is an engineer. "In India, for kids like me who were good in math, you could be either a doctor or an engineer," he tells me. "I'm from a Brahman background, in which hurting animals is frowned upon, and student doctors must dissect animals." Srinivasan earned a bachelor's degree in civil engineering and a master's in aeronautical engineering in India, then a Yale doctorate in mechanical engineering. But wanting to apply engineering to biology, he joined Yale scientists studying the skin's touch receptors.

"When they hired me, they probably thought I'd maintain their equipment, but I found the science so fascinating that for the first three months I just read papers," he says. "I didn't know what a neuron was, but I discovered that my basic interest was understanding the science of natural phenomena." We are talking in his MIT office. It might be any corporate chief engineer's office, with two computers and two tables neatly stacked with books and reports. But one item resting nonchalantly atop a stack of papers is surreal: a rubber hand. "I got that as a curio, but I've used it in some tests," he says.

It is eclectic, this lab that uses instruments so advanced they must be invented here and also something as mundane as a rubber hand. And that breadth is reflected in the funding sources for the 14 researchers, ranging from the National Institutes of Health, Massachusetts General Hospital and Harvard University, to the Office of Naval Research and the Defense Advanced Research Projects Agency. "'Haptics' really refers to touching and feeling with any part of the body. For me, haptics is associated with almost anything you can do with your hands," Srinivasan says. Ultimately, his research leads us to the brain.

"Where does the hand end?" Srinivasan asks. "Not really at the wrist, because tendons in the forearm control hand movements." That reminds him—hand components mostly come in twenties. Depending on how you count, he says, each hand comprises about 20 bone segments, joints that allow for 20 degrees of movement, 20 forearm muscles controlling the hand, 20 muscles in the hand itself, and about 20 nerve types. "And nerves from the hand go all the way to the brain," Srinivasan explains. "So the hand really ends at the brain."

From your fingertip, information travels up your nerves as an electrical impulse. "It's very slow compared with our man-made electrical stuff, just 100 to 150 feet per second, versus the speed of light," notes Srinivasan. "There are pain fibers that transmit at only three feet per second, so you don't pull your hand away until you've already burned it!"

Srinivasan looks thoughtful. "The

They want their children to care about them, not for them.
They want to live in their own home, not a nursing home.
They have long term care insurance from a name they trust — GE.

Preserve your independence and protect your retirement savings with a leader in long term care insurance.

Today you're both healthy. But what if you become unable to care for yourselves? Nursing home care costs average more than $40,000 a year[1] and can quickly deplete your retirement nest egg. That's why there's long term care insurance, to protect you if you ever need care, with options including care in your own home, an assisted living facility or a nursing home. GE's Long Term Care Division pioneered this insurance in 1974, and we've been a trusted leader ever since. So when you think of long term care insurance, think of GE.* For more information from a licensed representative[2], call 1-800-THINK GE.

We bring good things to life.

www.ge.com/longtermcare

---

[1] Wall Street Journal 3/31/99

Offer not available in all states.

[2] Insurance products underwritten by General Electric Capital Assurance Company and GE Capital Life Assurance Company of New York, members of the GE Financial Assurance family of companies. Policy form series #7030, 7031, 7032.

brain is in a dark chamber, with no information except for those electrical impulses that are coming in from the nerve fibers," he observes.

This aspect of the hand remains an arena of great mystery. "We have no idea how these electrical impulses translate into perceptions and feelings," Srinivasan says. "We don't even know how to talk about consciousness." But the lab's engineers *can* study the mechanics of the hand—its characteristics as a physical object. And touch, Srinivasan points out, is unique among the senses. Seeing or hearing or smelling or tasting, you take in information, either photons or air-pressure pulses or molecules, he says. But when you touch something with your finger, you not only take in information to relay to "headquarters"—the object's hardness or roughness or coldness, for instance—but you also exert force against the object. Your coffee cup's weight stretches your fingertip skin, but your fingers squeeze the handle. "We use our hands to explore the external world, and then we use our hands to manipulate the external world," Srinivasan says. "And just as optics are important for the study of sight and acoustics for the study of sound, mechanics are important for studying touch."

Back in the lab, I watch researcher Balasundar Raju slide colleague Tim Diller's wrist under the tip of an instrument that looks like a large, complicated Erector set contraption. It is a powerful ultrasound imaging system the lab developed, running at 50 megahertz, versus 1 to 10 megahertz for conventional hospital ultrasound devices. "Originally, we used it to image fingertip skin, but now we're looking for clinical applications, such as seeing if we can detect melanoma at very early stages, and we're trying to get the parameters of normal skin," Raju says, as he pulses inaudible sound waves into Diller's wrist. "No sensation," Diller reports. "We are all subjects in each other's experiments," he adds amiably.

"Each fingertip has about 2,000 receptors just for touch."

Another device measures properties of the finger pad: red dots indicate the site on the pad that is being studied.

As the humming machine's tip slowly moves over Diller's wrist, graph lines zigzag across a screen. "It's showing us the skin about two millimeters deep," says Raju. He can translate the graph lines into data about the structure of the subterranean layer of skin he is examining. By studying the skin of many people, he hopes to establish normal skin's characteristics. Eventually, the machine should be able to spot skin abnormalities, early warning for skin cancers. "But originally we used this machine to look at tissues—to find out how thick the epidermis is, for instance," says Raju. "And just as you have fingerprints and ridges on the outside of your skin, it turns out the epidermis also has ridges inside, at its lower boundary."

I am back in Srinivasan's office. He is telling me what the researchers see as they aim their ultrasound device at a fingertip, burrow down through the fingerprint ridges, through the epidermis and the buried ridges along its underside, into the dermis layer, then down into layers of fat. "There are thousands of nerve receptors of all kinds in the fingertips," Srinivasan tells me. Some of those nerve receptors are for touch, but not all touch receptors are the same: each responds to its own kind of stimuli.

"There are also receptors that sense the forces against your skin. There is one kind of receptor for heat and another kind for cold," Srinivasan points out. Heat receptors respond to temperatures above body temperature, cold receptors to temperatures below body temperature. "And there are receptors specialized to detect mechanical pain or thermal pain or chemical pain, and still other receptors are for itch," Srinivasan says. Some receptors seem to sense the stretch of skin around your joints as you move, providing one of the cues for kinesthetic sense—even with your eyes closed, you know whether your fingers are splayed or clenched, for instance, or where your hands and arms are in relation to your torso.

Fingertips are particularly dense with touch receptors. "Each fingertip has about 2,000 receptors just for touch," notes Srinivasan. And then there are receptors that detect other sensations, such as pain. "The density of receptors falls off rapidly by the time you get to the palm." Each touch receptor transmits the limited sensations in which it specializes to the brain. "And the brain blends it all," says Srinivasan. "We do modeling in a supercomputer, trying to figure out how all this works."

Our hands, it turns out, are stunningly sensitive. When he was a postdoc at Yale, Srinivasan reports, "we etched a single dot on a glass plate and rubbed it across fingers." Researchers there found that the human hand can detect a dot just three microns high—a human hair's diameter is 50 to 100 microns. Using a texture rather than a dot, the researchers found the hand can detect

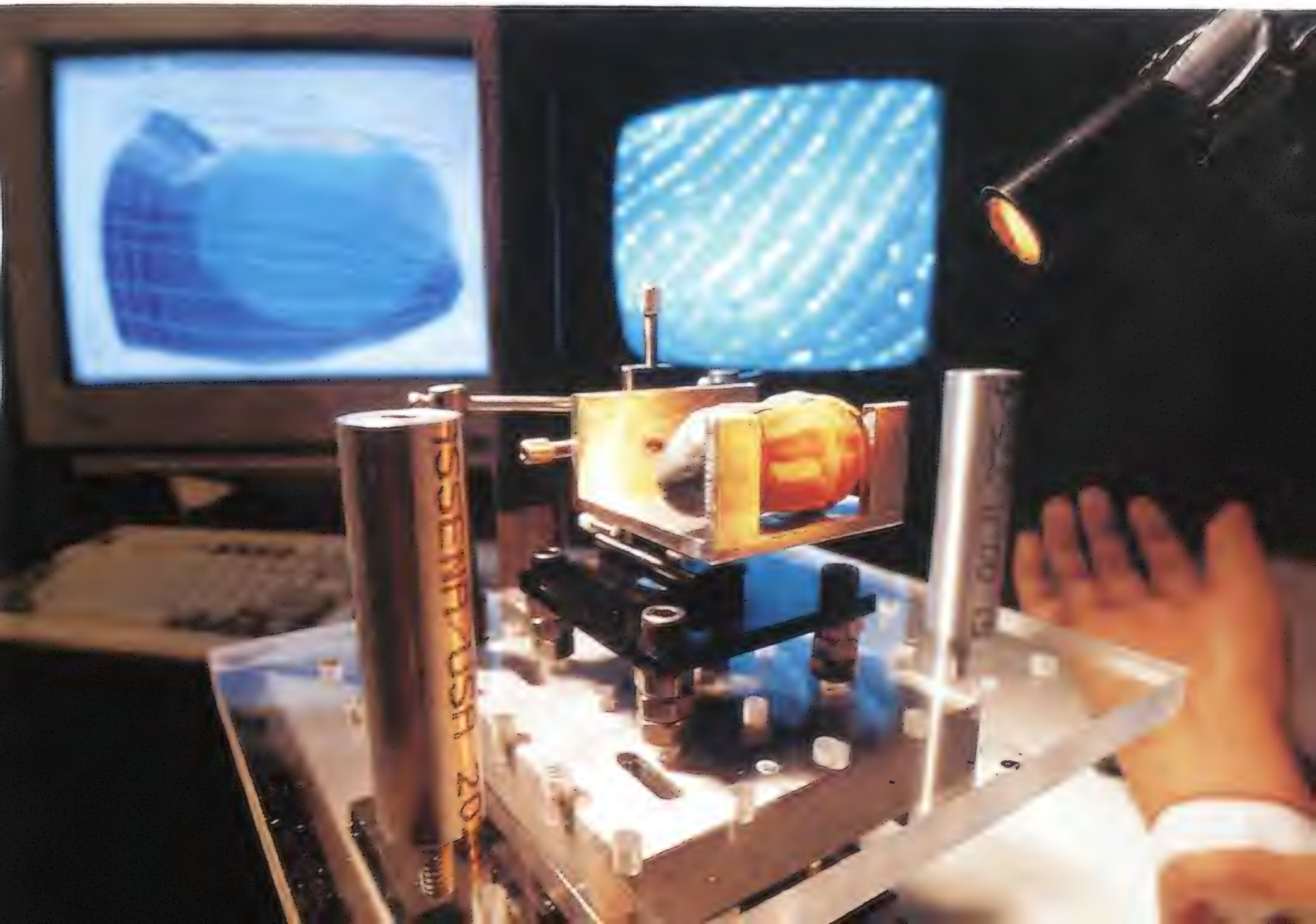
roughness just 75 nanometers high, which is tiny indeed. A nanometer is only a thousandth of a micron. Visible light has a wavelength of about 600 nanometers. "And using your fingernail, you can feel things that are even finer!" says Srinivasan.

In the retina, visual acuity is greatest at the center, the fovea centralis. As Srinivasan puts it: "Fingertips can be thought of as the fovea of touch." Fingerprints have piqued the researchers' curiosity. It is possible that the fingerprint ridges and the invisible ridges buried at the epidermis layer's bottom act as amplifiers, stretching sideways as the fingertip slides across, say, one of the lab's etched dots. Receptors buried in the fingertip skin detect the distortion of the ridges, then transmit the information to the brain.

Back in the laboratory, researcher Silmon James Biggs has airbrushed my right index finger with black ink and strapped it into one of the lab's machines. I am giving my finger to science. I feel a buzz in my fingertip, like a tiny electrical shock. A moment later, I feel a second buzz, slightly stronger. My task, each time I feel these paired buzzes, is to twist a knob until the two buzzes feel equal. This is an experiment aimed at improving virtual environments: in one of the buzzes I feel, the probe has contacted my fingertip head on. In the other, the probe has hit my finger tangentially. My data turns out to further verify what the lab has been discovering: fingers detect tangential impulses and straight-on impulses equally well. That will make it easier to add touch to virtual environments. But the research also encompasses a further study of fingerprints.

"It's unknown what role the ridges at the bottom of the epidermis play in this kind of touch, so we're looking at cadaver tissues," Biggs explains. "Observe how the ridges on the sur-

A video microscope magnifies the structure of a fingertip: the computer screen at right offers a view of a detail; the screen at left shows a computer model of the fingertip. The rubber hand, bottom right, often seen lying around the lab, is a kind of talisman.



face of the skin and the ridges underneath compress and stretch." Perhaps I grimace. "I don't care to cut up monkeys myself," Biggs says. "Cadaver tissue may be gruesome, but it's more my speed."

He tells me that skin ridges may also help to enhance grip, even though the ridges on your palm and fingers actually decrease the surface area of skin touching an object. "But there are a lot of sweat glands in the fingertips, perhaps more than in any other part of the body," Biggs tells me. He says that our skin, when we grip something, may act like a sponge on glass. "When the sponge is moist, there's more friction and a better grip," he observes. He shows me an electron microscope photograph of a fingertip's ridges, enormously enlarged. Each ridge is dotted with white specks, each a sweat gland. "So finger ridges might be for holding moisture," Biggs explains.

It is a complex gadget, our hand. And that raises a question: How did a mere paw evolve into an appendage so sensitive it can perform Mozart's violin sonata in E-flat major?

How did a mere paw evolve into an appendage so sensitive it can perform a Mozart sonata?

In his book *The Hand*, neurologist Frank R. Wilson, of the University of California at San Francisco School of Medicine, outlines current thinking about the hand's evolution. As Wilson puts it, "no serious account of human life can ignore the central importance of the human hand." In fact, he believes our hands and brains evolved together. According to Wilson, the hand (and brain) took a step forward about 60 million years ago, when squirrel-size early primates took to living in trees and made appropriate physical alterations. For one thing, their paws changed: the thumb—although not yet opposable—became more mobile, the better to grip branches. Also to make feeding easier, nails replaced claws. And palms developed sensitive skin ridges.

By about 10 million years ago, our tree-living ancestors had "learned" that making one's way across the top of a branch is a precarious transportation method. Better to hang from a branch and swing along below it, a technique called brachiation. But swinging required a loosening of the attachment between the wrist and the major forearm bone, the ulna, to allow extra arm twist and wrist tilt. By about 5 million years ago, when the hominids got going, the use of the hand assumed an even more primary importance.

Currently, anthropologists believe our earliest ancestor was the hominid genus *Australopithecus*, personified by the famous "Lucy." These creatures were bipedal, walking on their two hind legs. Lucy could join her thumb, index finger and middle finger to form a three-fingered grip, the baseball pitcher's "three-jaw chuck," enabling her to pick up and hold oddly shaped objects, such as stones. And Lucy's hand could repeatedly pound a rock, say on a nut, possibly because her new wrist for brachiation also absorbed more of the pounding's shock. Meanwhile, bipedalism gave Lucy an edge: her arms and hands, no longer essential for locomotion, could throw stones.

Perhaps the final piece in the human hand's modernization was the ability of the pinkie and the ring fingers to oppose the thumb. That made it possible for early hominids to

This close-up image of a human hair contains a black line superimposed on its surface: this line represents approximately 1/300 the width of a hair, or about 300 nanometers. The human finger can distinguish textures as small as 75 nanometers.

RICHARD SCHULTZ AND ANTHONY GARRATT-REED/MIT

*Driver and passenger front crash test. Testing conducted by the National Highway Traffic Safety Administration (NHTSA), Government [illegible] for data only. [illegible] impacts for this vehicle within 500 pounds. The Chevrolet Emblem, Impala and the Impala Emblem are registered trademarks and Chevy is a trademark of the GM Corp. ©1999 GM Corp. All rights reserved.

WE DIDN'T JUST STOP AT CAPTURING THE SHEER JOY OF DRIVING.

★★★★★ *Chevy Impala has earned a five-star government front crash test rating.**

It's the highest possible government rating for frontal impact and the all-new Chevy Impala has just earned it. That's something Toyota Camry, Honda Accord and Dodge Intrepid have yet to accomplish. Rediscover the joy of driving in a car designed, engineered and built to be carefree. Call 1-877-4-IMPALA or visit chevrolet.com for more information.

THE NEW CHEVY IMPALA
Let's go for a drive.

swing a stick as a club. But modifications for stone-pitching and club-swinging conferred yet another advantage: our ancestors could manipulate small objects with just their fingers, without clenching them to their palms. Now they could go into the toolmaking business.

Wilson points out it was not just the hand's structure that changed for club-swinging and stone-chipping. So did the brain. For instance, swinging from branch to branch required enhanced hand-eye coordination. Touch also needed enhancement, demanding more brain rewiring. And the swinger needed a refined kinesthetic sense of how its arms and hands and legs were positioned as it flew through the air toward the next branch. In other words, says Wilson, to be a successful aerial acrobat, and then emerge as a stone-chucking and club-wielding predator, "demanded a bigger brain with very specialized control characteristics."

In the Touch Lab at MIT, I tell Mandayam Srinivasan that one thing puzzles me. I can see how the mammalian paw might evolve into a hand capable of knapping flints and throwing spears. But if a driver of evolution is the likelihood that survival-enhancing physical changes will get passed on to offspring, what about accomplishments that don't help you to survive? How did the human hand get to play a mean violin?

Srinivasan shrugs. "I see no problem with that," he says. "Hands develop the basic capability of, say, chipping stones—to grasp, to apply forces over time and over space, pressing with this finger, then another finger." Once bones and muscles have adapted to such tasks, and the brain's "wiring" has adjusted, it is up to the brain to learn the hand's new repertoire of movements, in order to perform a new task. And so I spent several childhood years trying to learn to play the piano. I failed, but it was not my hands' fault. "Rock-throwing and violin-playing are on a continuum," says Srinivasan.

I decide to end my foray into hand research by visiting a palmist. As we sit in a coffeehouse, the palmist prods my hands and examines my fingers. He is a tie-wearing administrator in state government, with nothing to suggest so arcane a spare-time hobby. "I look at the skin texture, and the hand's flexibility, and the individual fingers and lines and the overall shape," he says. "You're a person who sets very high goals for yourself, and then you measure yourself by what you don't achieve—that's how you approach life," he says. Except for two short telephone conversations setting up this session, we met just five minutes ago. And he has hit upon one of my core traits.

He cites attributes and faults he reads in my palms' hollows and lines and my fingerprint whorls. Easy generalities, applicable to almost anyone? Who knows? As he continues to "read" my palms and fingers, odd thoughts bubble up.

"Give this man a big hand—you've got to hand it to him," I think. And I think about how we make contrasts by saying "on the one hand," and "on the other hand." We say someone "writes a good hand." Ships are crewed by "all hands." Horses stand so many hands high. "A bird in the hand," we say, and "firsthand information." We may go cap in hand, or hand in hand, or climb a rope hand over hand. "Hands up," says the robber. Our best employee is our right-hand man. We have situations in hand. We take responsibility in our own hands. Sometimes our hands are tied. We work hand in glove with trusted associates. We give our daughters' hands in marriage. We may bite the hand that feeds us, or get the upper hand, or have a free hand, or live from hand to mouth. We wash our hands of problems. Sometimes we act high-handedly—or win hands down.

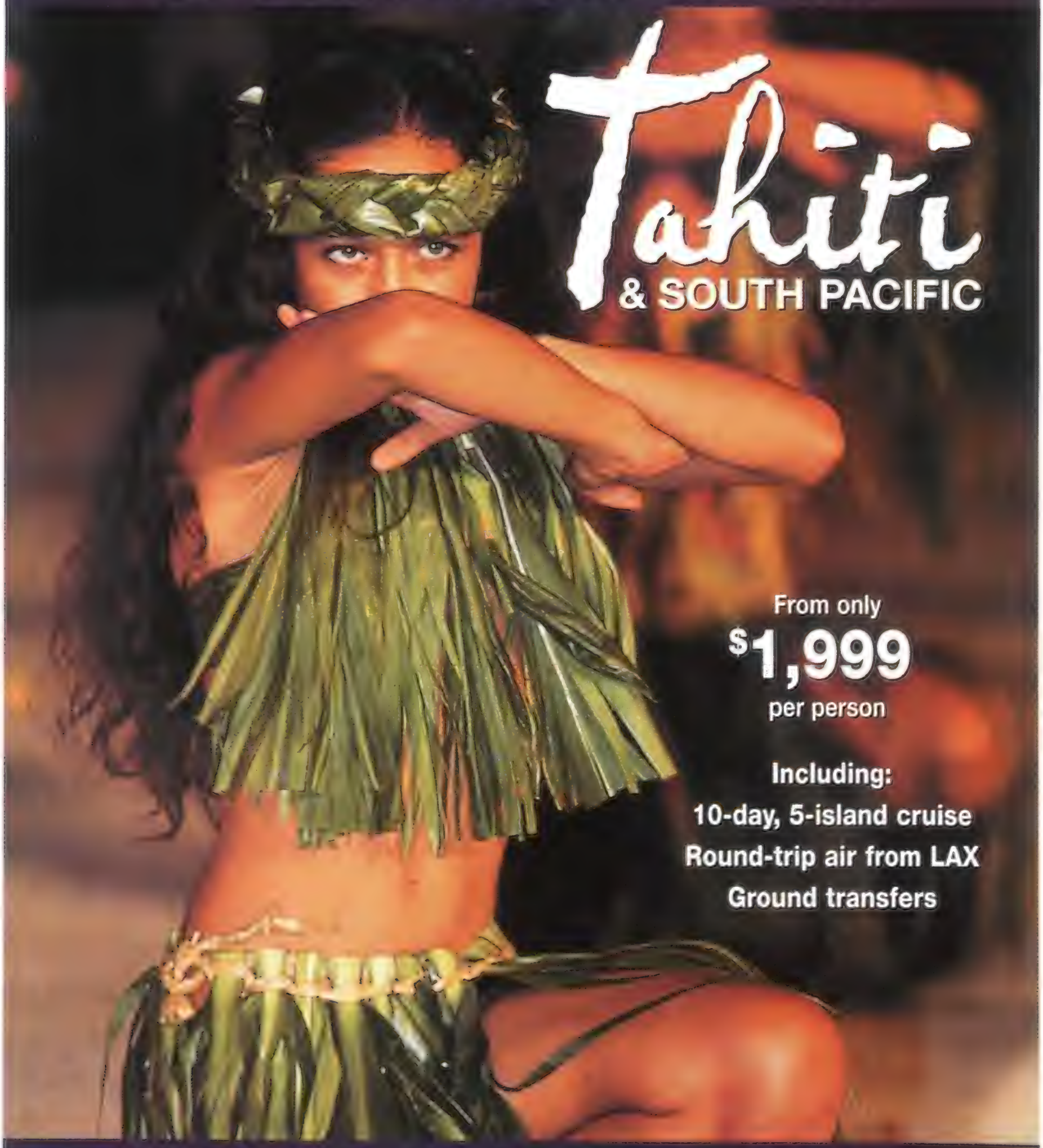
Mandayam Srinivasan, at the MIT Touch Lab, said "the brain is in a dark chamber." It must be that our enchambered brain has created so many hand phrases because it relies on our hands for a feel of the world, and to get a grip. And I wonder about this polite man in the coffeehouse, trying so hard to report what he "reads" in my hands in words that are not hurtful. Did his art arise because the ancients, knowing nothing of neurons and electrical impulses, still grasped that our hands begin in our heads? Dr. Frank Wilson told me about a time when he addressed a group of doctors: "I reminded them that a surgeon operating on a violinist's hand is doing brain surgery."

Dr. Frank Wilson told me about a time when he addressed a group of doctors: "I reminded them that a surgeon operating on a violinist's hand is doing brain surgery."

Leaving the coffeehouse, we do the natural thing, the palm reader and I. We shake hands.

Richard Wolkomir, a regular contributor, is based in Vermont. Photographer Richard Schultz works from Boston, Massachusetts.

2-FOR-1 CRUISES!



Tahiti
& SOUTH PACIFIC

From only
$1,999
per person

Including:
10-day, 5-island cruise
Round-trip air from LAX
Ground transfers

TAHITI • MOOREA • HUAHINE • RAIATEA • BORA BORA

Sail Dates: September 1, 4, 11, 14, 21, 24 • October 4, 14, 24

Renaissance Cruises

CALL TOLL FREE **1.888.234.3261** 7 DAYS A WEEK

www.RenaissanceCruises.com

Government fees and charges are additional. Ship's Registry: Gibraltar.

YK9

Afloat with Fly Boats & Leggers

ENTHUSIASTS ARE REDISCOVERING THE VAST SYSTEM OF NARROW CANALS THAT CONNECTS ENGLAND'S BYWAYS AND BACKWAYS

BY SUSAN HORNIK

WHEN LINDA ANFUSO WAS GROWING UP IN UPSTATE New York, not far from the St. Lawrence Seaway, she read about the dwindling number of English boat men and women still living on canals with their families and hauling cargo as they had for almost two centuries. Enchanted by the depiction of their dying way of life and the graceful charm of the canals meandering through a timeless countryside of hedgerows and thatched villages, she dreamed of living on one of the gaily painted "narrow boats" that the families called home.

Twenty-five years later, Linda, now a painter and university lecturer, and her husband, Dennis, a cartoonist and writer, have realized her childhood dream. On a sunny day in May, they sit on the small deck of their red and green seven-foot-wide boat, *Ann*, in Browning's Pool, a pond-size junction of two canals in the heart of West London's Little Venice district. Surrounded by the boats of other waterway aficionados, they're enjoying one of a score of the country's annual narrow boat festivals, trading stories with friends about engine failures and lock repairs. On the towpaths and nearby grassy banks, craftspeople in tents hawk painted tinware, handwoven rope fenders and homemade ginger fudge. The air is filled with the smell of frying sausages and onions. One booth advertises narrow boats to rent or buy. Another sells pots of herbs and flowers, popular adornments for the boats' flat roofs.

The Anfusos spend half of each year writing and sketching in their floating studio and home, puttering at a leisurely four miles per hour around England's canals. Today Linda is wearing traditional canal finery, as enthusiasts sometimes do: a brimmed black bonnet, a plum moiré silk blouse with leg-o'-mutton sleeves and an ankle-length skirt of black linen. "There's a sense of community here that our parents and grandparents talked about, but we never knew," she says.

More than 60 years ago the desire to salvage the canals, and keep alive the sense of community, camaraderie and tradition that they foster, inspired another dreamer. Tom

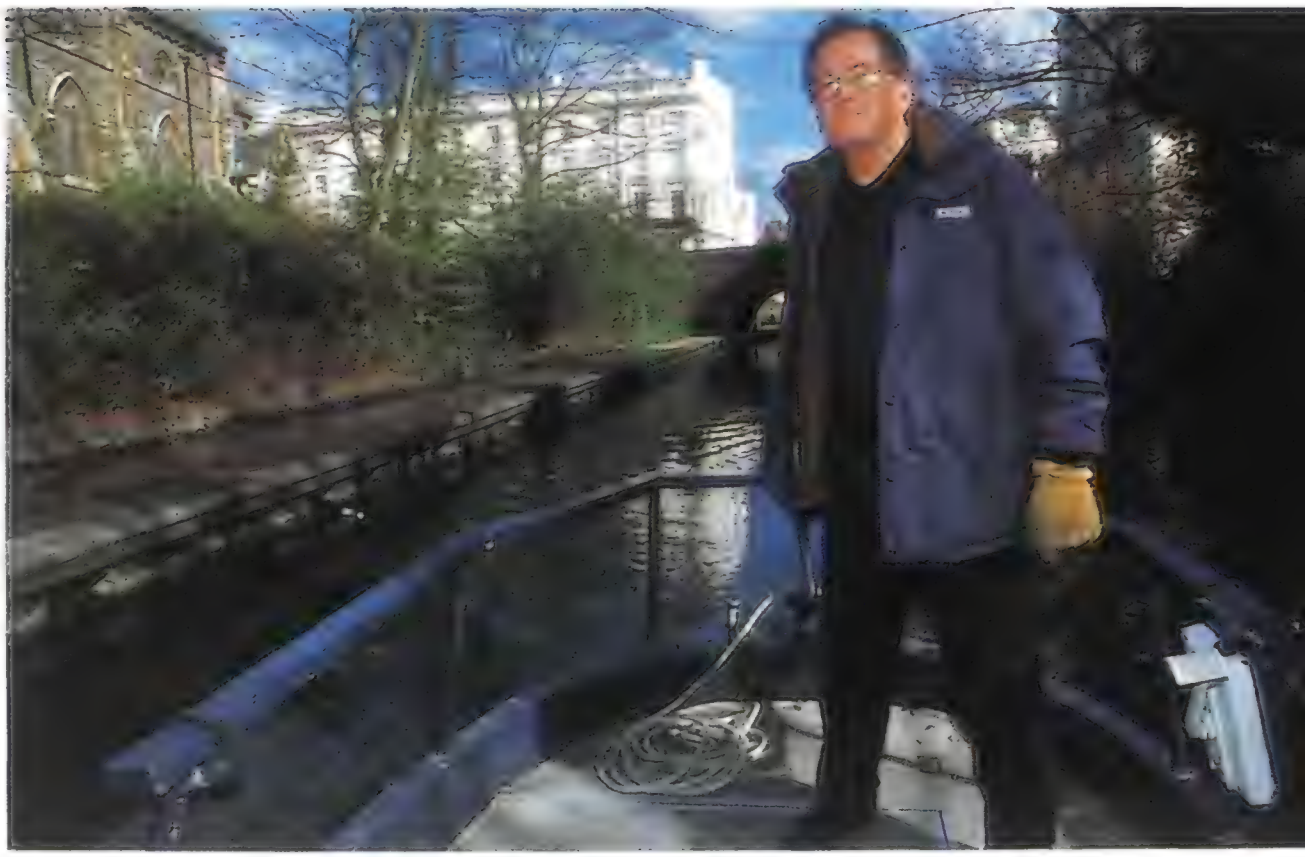
PHOTOGRAPHS BY MICHAEL FREEMAN

Time pauses in England's Napton-on-the-Hill (opposite), where brightly colored "narrow boats" still run the Oxford Canal in the shadow of the lockkeeper's cottage.

Rolt, an English engineer, motorized the *Cressy*, an old Shroppie fly boat—canal jargon for a narrow boat built by the Shropshire Union Canal Company to haul cargo day and night using relays of horses. Rolt wrote a passionate celebration of his 400-mile odyssey along the Oxford and other heartland canals. The tranquillity of the hidden England that he described and the unique art, language and folkways of the boatmen he met helped spark a movement that has led to the restoration of well over half of the 4,000 miles of crumbling waterways. Though too late to save the coal-carrying boat families Rolt extolled, a new canal-based community has sprung up with its own activities and fiercely loyal enthusiasts. "It's not for a privileged few," says Brian Collings, an interpretation officer at the Stoke Bruerne canal museum. "There's something for all—wildlife, towpaths for walkers, unique scenery for artists, industrial archaeology, fishing." Some boats have been turned into floating art galleries, tea shops and studios. Lock houses have reopened as pubs. Last year, 250,000 vacationers rented canal boats for floating holidays.

A half-hour's stroll from Little Venice on the former horse towpath, journalist and author Jim Jackson is readying his narrow boat, one of a dozen moored end-to-end in the middle of Regent's Park on Regent's Canal, for a cruise up the Grand Union. Nearby boats are a medley of red, maroon and green. Some have painted diamond patterns on their bows or rose swags on their cabins. Like all the others, Jackson's boat, a sedate navy blue, has its name—*Symposium*—writ large on its side in scrolled and shaded lettering, reminiscent of a circus wagon.

Jackson, a fit, 60-year-old New Mexico native, switches on the motor and casts off the mooring lines, then grabs the tiller and jockeys the awkwardly



Above: Jim Jackson guides the *Symposium* through London on Regent's Canal. Below: Duncan Price demonstrates the taxing art of legging a narrow boat through a tunnel. Opposite, above: Val Todd serves tea on the Huddersfield Canal in West Yorkshire. Opposite, below: Boatbuilder Nigel Jackson leans on a narrow boat designed to break ice.

thin 50-footer into a tight semicircle and heads southwest, past the Arabian oryx grazing on the hillside at the London Zoo in Regent's Park. The *Symposium* glides underneath the Macclesfield Bridge, where decades of wear from horse-drawn towropes have left thumb-size grooves in the Doric columns, and into the dank, mineral-stained Maida Hill Tunnel. It is as though the outside world has been swallowed by darkness. Some 270 yards long, the tunnel is not much wider than one boat, and the ceiling is low enough to touch. In the pitch darkness the puttering of the engine

becomes a pounding echo, the smell of diesel smoke grows acrid and the temperature plummets. The crumbling brick and patched concrete walls are a reminder of an earlier age when a green and rural England came face-to-face with its gritty industrial future.

Two hundred years ago the rapidly expanding tentacles of the waterway system fostered not community but wrenching change. When England's main rivers, notably the Severn, Thames, Trent and Mersey, were connected to an extensive network of canals, rural villages found themselves suddenly in contact with the outside world, extras in the extraordinary drama that was England's great industrial—and social—revolution.

Today's enthusiasts are only the most recent in a long line of passionate actors who have contributed to the canals' colorful history. In 1758 the third Duke of Bridgewater had the radical notion of building a private canal connecting his coal mines to the cotton mills of Manchester six miles away. The 22-year-old duke, fresh from an unhappy love affair with the Duchess of Hamilton in London, threw himself into the project. As belief in his canal grew into an obsession, his personal fortune dwindled, and he mortgaged his estates, sold his house in London and borrowed from relatives, manufacturers and local farmers alike to finance the ever-more ambitious undertaking (the canal would eventually extend 46 miles).

To construct his canal, the duke employed the equally single-minded millwright James Brindley, who had a reputation for inventiveness with mechanical devices. Since the civil engineering profession was in its infancy and detailed contour maps of England did not exist, Brindley had to do his own surveying, and design and build as he went along. A man of no formal education, he modeled aqueducts in cheese, and dug a trial lock in his backyard. When faced with a challenging problem, he would take to his bed, sometimes for days, emerging only when he had solved the engineering difficulty. Until his death at 55 he had played a role in every major canal project in Britain.

Brindley's designs set the norm for canals in the English Midlands. They closely followed the contours of the landscape. And although he built the duke's canal wide enough for river barges, his later canals were unusually narrow, with locks only 7½ feet wide, to save money during excavation and use a minimum of water. They were also shallow, 8 feet deep at most. Lock width and canal depth in turn dictated the development of the 7-foot-wide, 70-foot-long narrow boat, which needed little water in relation to its carrying capacity of some 30 tons, and was cheap to make and fast to build.

Besides historic charm, narrow boats hold a less tangible appeal: for permanent and weekend liveaboards, hopping onboard makes the world suddenly simpler, cozier and more manageable. Modern cabins generally

extend almost the length of the vessel, downright roomy compared with the original boats' cramped cabins that were jammed typically behind a long cargo hold. Still, like a page out of *Alice's Adventures in Wonderland*, everything inside the cabin is slightly out of scale—a miniaturized version of life on land. A couple of steps down from Jim Jackson's tiny foredeck, a combination living room, study and kitchen has polished ash cupboards, shelves and a dining nook built-in for convenience. Other boats, like the Anfusos', have all the modern amenities in a long forward cabin, but preserve a traditional 10-by-6-foot back sleeping cabin with a coal stove, a cupboard door that drops down into a bed, walls painted with fake oak graining, and built-in benches and cupboards decorated with Sheraton rose-and-castle designs.

Rows of windows on both walls of Jackson's boat offer glimpses of canal life—joggers, a 50-seat puppet theater barge, a floating tea shop. A narrow hallway leads past a compact bathroom and shower to a sleeping area barely large enough to squeeze in a double bed. From there, four steps head up to the afterdeck, roomy enough for a party of six, where Jackson mans the tiller and jokes with canal regulars as he motors by. In truth, with the canal just large enough for one boat to pass in each direction, the *Symposium* all but steers itself. Even at a flat-out four miles per hour, there's hardly a wake, and the slow pace and rhythmic pounding of the engine are hypnotic.

Back in 1761 when the Bridgewater Canal opened, it made the duke a rich man and captured the popular imagination not for its serenity but for its novelty and the economic opportunities it offered. On seeing this engineering marvel, Josiah Wedgwood, the porcelain manufacturer, exclaimed, "To behold ten of these locks all at a view, with their Gates, Acqeducts, Cisterns, Sluices, bridges, &c. the whole seems to be the work of the Titans, rather than the production of our Pigmy race of beings. . . ." He immediately realized the advantages canals offered. Coal brought by land had cost 65 pence a ton; by canal it cost 35 pence.

Inspired, Wedgwood organized a group of Staffordshire potters and merchants from Liverpool in the 1760s into a joint stock company to finance a canal that would transport goods between Liverpool warehouses on the Mersey River and the pottery factories. An innovator throughout his long career (he was apprenticed at age 9), Wedgwood had experimented extensively with different clays and glazes until his pottery rivaled European delftware. But in his desire to increase output, he faced a problem common to the budding manufacturers of his day: a transport bottleneck. Raw materials of flint, clay and china stone were taken by sea from the southeast coast of England to the Mersey, loaded onto barges for a trip up the Weaver River and then hauled by packhorse over nearly impassable roads to the potteries. The trip to market for his delicate porcelain was even more treacherous. Roads at the time, according to one frustrated observer, were "narrow, deep, circuitous, miry and inconvenient."

The canal system's most astounding engineering feat may well be the Pontcysyllte Aqueduct in Wales, a dizzying 1,000-foot traverse of the River Dee. Nineteen slender stone arches prop the cast-iron trough and accompanying towpath 126 feet above the surface of the river.

James Brindley spent 11 years building Wedgwood's 93-mile-long Trent & Mersey Canal, which today wends its way through both half-timbered villages and industrial towns. Its success, upon opening in 1777, initiated a period of frenzied canal building.

Like the Trent & Mersey, each canal offers boaters a unique view of the pageantry of England's history. Jim Jackson regales his crew-for-the-day with a favorite tale about the Macclesfield Bridge. During the era of horse-drawn loads, a narrow boat carrying sugar, nuts, fuel and gunpowder caught fire and exploded with such force that it blew up the bridge, damaged nearby homes and killed the crew. The Doric pillars, which survived, now support the new bridge. Just before angling the *Symposium* into the Paddington arm of the Grand Union, Jackson points out an old yellow-brick tollhouse, recently renovated. Most canals were local or regional enterprises with separate gauges, designs and management, and each company charged a separate toll of so many pence per ton per mile.

As Jackson steers the boat slightly northwest, the blocks of elegant Victorian mansions give way to industrial warehouses, then rural countryside, dotted every few hundred feet with fishermen sitting on foot-high tackle boxes and dangling poles some 20 feet long that they pull up as the boat glides underneath.

By the early 1790s, more than 50

Right: This pair of sleek, seven-foot-wide canal boats will take 25 minutes to climb 60 feet in the Bingley Five Rise locks on the Leeds & Liverpool Canal in Yorkshire. Below: Swan's neck, Turk's head and rosette knots adorn a canal boat's rudder and tiller. Opposite: Sixteen of the 29 locks on the Caen Hill section of the Kennet and Avon Canal, outside Bristol, assume the shape of a staircase, an obstacle course that takes a canal boat four hours to negotiate at a rate of climb equal to one inch for every 30 inches traveled.

canals were under construction. Owners of potteries, textile mills, ironworks and brickyards quickly realized the importance of obtaining canalside sites. A horse pulling a barge could move more than 15 times as much cargo as one pulling a wagon on a good road. Former hamlets became bustling commercial centers. One early account marveled, "Houses, warehouses and inns . . . sprang up as if by magic."

Everyone from wigmakers to vicars scrambled to buy canal shares. As the speculative bubble grew, con men sold impractical schemes, canals were constructed with little thought to adequate water supply and companies soon began to go bankrupt. Some canal projects had to be scrapped entirely.

Nowadays, groups of trained volunteers aid local trusts around the country tackling ambitious restorations that range from cleaning up abandoned canals and repairing bridges to refitting lock gates and building back-pumping mechanisms. On a typical weekend at the Lichfield and Hatherton Canal, north of Birmingham, Eddie Jones, a hearty radio engineer with ginger hair and a matching beard, is leading 15 volunteers from the Kent and East Sussex Canal Restoration Group (KESCRG). The volunteers, who range from 20-somethings to retirees, are rebricking the foundation bridge at the Tamworth Road Lock. The canal, formerly filled in and recently redug, resembles a busy construction site. Although these workers use bulldozers and backhoes, they respect the past. When the Droitwich Canal, one of Brindley's earliest designs, was on the verge of collapse, volunteers worked with historians to replicate the canal's Linacre Bridge. "We even adjusted the mortar mix to 18th-century standards," says 22-year KESCRG veteran Ken Parish.

After Brindley's death—and befitting the country's growing wealth—engineers built progressively grander canals with dramatic series of locks, arched bridges and soaring aqueducts. The one heart-stopping moment in the *Symposium*'s trip on the Grand Union occurs high atop the prosaically named North Circular Aqueduct. Floating in a boat on a ribbon of water while looking down a hundred feet at cars whizzing along a superhighway gives new meaning to the word "vertigo." Worse, because the water level of the canal is only some six inches below the narrow towpath, there's a feeling that a sudden wave could slosh the entire boatload over the edge and into the speeding traffic below. Jackson helpfully points out that the 12-inch space between the boat floor and its flat bottom is packed with paving stones for ballast, so that nothing short of an earthquake could send the boat over the side of the bridge.

When England's main rivers were connected to an extensive network of canals, rural villages found themselves suddenly connected to the outside world.

The canal system's ultimate high, according to boaters and engineers alike, is the Pontcysyllte Aqueduct, just over the border in Wales. The 1,000-foot-long cast-iron trough is supported by 19 slender stone arches, each with a 45-foot span. The canal, towering above the River Dee, has a towpath and railing on one side and a sheer 126-foot drop on the other. Upon viewing the Pontcysyllte, completed in November 1805, poet Sir Walter Scott called it "the most impressive work of art" he had ever seen.

Building the aqueducts, bridges, locks and canals was the task of thousands of anonymous workers equipped mainly with gunpowder, axe, shovel and spade. By the 1790s an estimated 50,000 men worked on canal navigations, hence their nickname of navigators (or navvies).

Although battling the waters of the swirling Dee challenged builders, no job was more dangerous than the digging, shoring up and mucking out of tunnels. Fifty men died blasting out the Standedge, northeast of Manchester and England's longest at more than three miles. Crews worked for 16 years, often by candlelight, 638 feet below the Pennine Mountains and hauled up sludge in buckets through shafts. The tunnel, which first opened

Volunteers from the Dorset and Somerset Canal Group have begun to clear away a century's worth of vegetation clogging a 17-foot-deep lock on a canal near Bath.

in 1811, is now under reconstruction.

Outfitted in hard hats, overalls and knee-high Wellingtons, project engineer John Hallam and his crew have spent eight months slogging through 30,000 tons of muck, collapsed rock and silt. They have reinforced the tunnel walls with stainless steel bolts to prevent cave-ins and are now using centrifuges at each end to separate the water from sludge that measures six feet deep in places.

Like Standedge, most tunnels had no towpath, so all boats had to be "legged" through, a skill now relegated to museum demonstrations. Boatmen would lie on their backs atop boards, moving the boat along by pushing against the wall with their hobnailed boots in a cadenced sidestepping rhythm. One company recommended that leggers "strap themselves to a short Cord affix'd to the Boat to prevent their being drown'd." In the English classic series *Horatio Hornblower*, Captain Hornblower himself is forced to leg through one of the most famous tunnels—the two-mile Sapperton—in "the strangest sort of mesmeric nightmare." His aching legs and wet feet, mixed with the deafening sound of cataracts of water cascading down on men and boat, made him appreciate his far more pleasant life on the high seas.

Unlike life at sea, on the canal wives often joined their husbands on the boats. They brought more than children and an extra pair of hands. By the mid-1800s the utilitarian narrow boat had bloomed into a garden of stylized roses. Fairy-tale castles amid lake and alpine scenes adorned chests, stools and doors. By bringing aboard a taste for the popular decorative motifs of the time, women gave each boat a unique identity.

During the 19th century, with families living on board, boat communities became increasingly closed and cut off. Generation after generation of the same families stayed on the canals, clinging to bygone fashions, language and mores. By the mid-19th century when the country had gone railway mad and the canals began a decline as slow and meandering as their channels, boat people were increasingly viewed as a rough and ignorant race. To the Victorians canal life seemed to foster drunkenness and violence. Boats and cargoes often crushed unwary family members, and drownings were not uncommon. One reformer claimed that more than 100,000 people lived on the canals "in a state of wretchedness, misery, immorality, cruelty and evil training."

Although the glory days of the narrow boats were brief, canal companies continued to modernize the system through widening, straightening and redesigning locks. One of the most eccentric experiments in canal history is the Anderton vertical boat lift, built in 1875 to transfer boats between the Trent & Mersey Canal and the Weaver River, some 50 feet below. The 113-foot-high Rube Goldberg contraption contains a pair of water-filled iron tanks, each large enough to hold a narrow boat. Using counterbalanced, steam-powered hydraulic lifts, one tank would lower a boat while the second lifted one up. Volunteer engineers hope to complete the restoration of this remarkable mechanism by 2001.

On the Grand Union, Jim Jackson and his sunburned guests wend their way back toward London. Bluebells nod on the banks in the midafternoon breeze. A gray heron inspects the boat's progress. The trip, less than 30 minutes at its farthest point from central London by train, has taken almost five hours. As one boat owner at the Little Venice festival said of canal travel, "You don't do it for getting there."

For the Anfusos and other live aboards, the opportunity to savor the simple pleasures holds the most appeal. "We have such a network of friends," says Linda Anfuso. It's the kind of life that means she can tie a kerchief on the tiller for the milkman and wake up to a bottle of milk in the morning.

Perhaps Tom Rolt summed up the joys of life on the canals most eloquently more than a half-century ago when he wrote: "To step down from some busy thoroughfare onto the quiet towpath of a canal . . . is to step backward a hundred years or more and to see things in a different, and perhaps more balanced perspective."

London-based writer Susan Hornik wrote about feng shui in the August 1993 issue. Michael Freeman's photographs of contemporary Japanese houses appeared last month

Take the daily commute in an entirely different direction.

CONCORDE

Drive to work. Drive back home. Repeat happily with the Chrysler Concorde LXi. A premium full-size sedan with an all-aluminum 225 horsepower engine and leather-trimmed interior with automatic climate control. LX model starts at $22,830. LXi model as shown, $27,070* Info? Call 1.800.CHRYSLER. Or visit www.chrysler.com.

CHRYSLER

Supermodels with 6 legs

PHOTOGRAPHS BY GILLES MERMET

When the world's greatest couturier presents a collection, she reserves her most fabulous designs for the insects. For more than 400 million years, insects have modeled Mother Nature's bold shapes and gorgeous colors, often with devastating allure. Tailored to the wearer, whether it dwells in the Amazon rain forest, beneath the boiling lava of a volcano or in the ice of Antarctica, MN's designs are wildly popular. Today some one million insect species—about 166 million insects per human—strut her stuff. To show the diversity of insects and how design aids in their survival, Gilles Mermet spent six months in the Muséum National d'Histoire Naturelle in Paris photographing tropical insects from among its 30 million specimens, one of the largest insect collections in the world. MN credits her choice of material with her designs' success. "I love the look, the feel, of chitin. Mandibles, exoskeletons, all those legs—nearly all chitin. It's the mainstay of every insect collection I've ever done." —Suzanne Crawford

Titanacris albipes (opposite), a lubber grasshopper from Guyana, flashes its purple hind wings to frighten its foes.

Dress for success (opposite, clockwise from bottom left): Two long-horned beetles, Petrognatha gigas *of West Africa and* Psygmatocerus wagleri *of Brazil, deploy outsize antennae to detect vibrations and odors, including pheromones produced by females; camouflage hues and a "Twiggy" profile allow a walking stick,* Cranidium gibbosum, *to blend safely into the Amazon jungle; the luna moth* Argema mittreï*—known as the Madagascar comet for its fiery tails—makes a big target with its 6½-inch wingspan, but the wings' four gaping eyespots may actually scare off predators.*

Accessorize, accessorize, accessorize (clockwise from top left). Like all cicadas, Pycna strix*—Madagascar's "little owl"—is equipped with piercing, sucking mouthparts to feed on plants; not just another pretty face, the click beetle* Semiotus imperialis *fools its foes in the Amazon basin by falling onto its back and playing dead, then, still supine, launching itself with a click from a special spring apparatus; when the katydid* Sanaa imperialis *takes to the skies of Thailand and Nepal, the colors in its forewings signal that it is toxic if eaten.*

COLLECTION OF THE MUSEUM NATIONAL D'HISTOIRE NATURELLE, PARIS

Accentuate the positive (above, clockwise from left): In Sri Lanka and India it's known as the walking violin, but the mantis Gongylus gongylodes *raises its barbed forelegs to make mayhem not music; beautiful to human eyes, the jewel tones of* Mecynorrhina torquata, *a scarab beetle of African forests, spell heartburn to would-be diners; a scarab of tropical Central America,* Dynastes hercules*—the Hercules or rhinoceros beetle—wins a female by literally "nosing" rivals out of the way; one of the world's most beautiful butterflies, the male* Morpho rhetenor, *or Cramer's blue Morpho, of South America, gets its sapphire sheen not from pigment but from a layer of scales that reflects only blue light; a similar phenomenon turns wingless cockroaches, Vietnam's* Trichoblatta magnifica *(opposite), into shining lights of Mother Nature's insect collection.*

THAT WAS **THEN.**

THIS IS **WOW.**

IN 1935, THERE WAS NOTHING ELSE QUITE LIKE THE CHEVY™ SUBURBAN. NOW, NEARLY 65 YEARS LATER, IT'S STILL AN ORIGINAL.

MORE POWERFUL VORTEC™ V8 ENGINES, AND IMPROVED TOWING AND HAULING CAPABILITIES. **THE BEST SUBURBAN**

©1999 GM Corp. Buckle up, America! 1-800-950-2438 or www.chevrolet.com

THE ALL-NEW 2000 CHEVY SUBURBAN HAS A MORE COMFORTABLE INTERIOR, SMOOTHER RIDE,

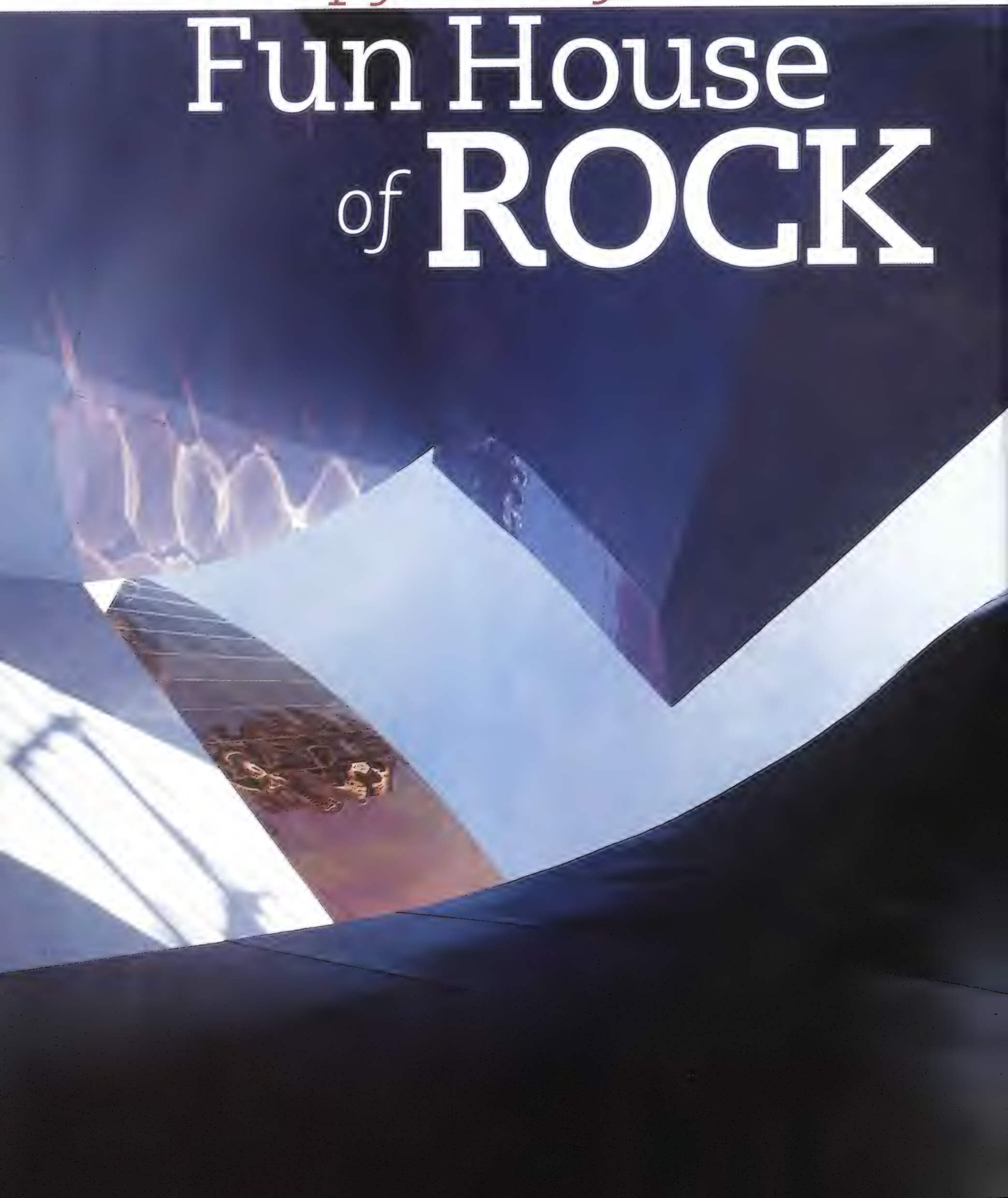
YET ISN'T MERELY AN EXTENSION OF ITS HERITAGE. IT'S THE BEGINNING OF A NEW ERA.

SUBURBAN

LIKE A ROCK

A Swoopy, Funky

Fun House of ROCK



SEATTLE'S NEW EXPERIENCE MUSIC PROJECT IS A $100 MILLION, TECHNOLOGY-ENHANCED REPOSITORY OF AMERICAN POP MUSIC WHERE ANYONE CAN BE A ROCK STAR

BY RICHARD COVINGTON

PHOTOGRAPHS BY STEVE GOTTLIEB

Reflections fill the view up the "canyon" (left), formed by wildly shaped exterior museum walls; Tom Chiado, EMP project manager, jams in Sound Lab (top); a handheld PC accesses jazz in the Milestones Gallery (center); and friends make music in a sound room (bottom).

HERE'S MY CHANCE. I AM SITTING AT A DRUM SET, READY TO PLAY LIVE AT THE "ON STAGE" exhibit at Seattle's Experience Music Project. Through billowing smoke, the lights sweep the stage. The filmed audience roars in front of me. I glance left to the guitar player, right to the singer—we're on. The right pedal pounds the padded hammer into the bass drum and my foot follows. The tom-tom lights up and I try to slap it on the beat. "Wild thaang," wails the singer as she reads the lyrics off a TelePrompTer. The guitarist struggles to keep up with the frets as they, too, light up to indicate the melody. "You make everythang grooovy." *Boom-boom, boom-boom.* I hit the snare almost on time. We're moderately terrible, but thanks to the computer program automatically playing the instruments and voice track, we sound like rock stars. The crowd is on its feet, cheering on this ersatz three-part karaoke to heights of greatness and embarrassment. Who knows? Maybe we'll even get lucky and hit a note on time and on key. Only later do I realize we could have switched off the autopilot and winged it on our own. Now *that* would've made history. Wouldn't it?

"I want to give people a taste of what it's like to be onstage performing in a rock and roll band, even if it's only for a few minutes," says veteran guitarist Paul G. Allen, front man for the Seattle rock group The Grown Men. "The idea is you'll make music a bigger part of your life if you can make your own music."

Allen, better known as the cofounder of Microsoft and one of the world's richest men, and his sister Jody Allen Patton have created not so much a monument to rock and roll as a $100 million hands-on fun house and technology-enhanced repository of American pop music that may well point the way for the evolution of museums in the 21st century. What began as a modest gallery to pay tribute to native son Jimi Hendrix has mushroomed into a 140,000-square-foot museum celebrating and demystifying musical creativity.

Designed by Frank Gehry, the nonprofit, privately financed Experience Music Project, EMP for short, opens June 23 on the grounds of Seattle Cen-

ter, the site of the 1962 World's Fair and home to a sports stadium, opera house, theaters, children's center, amusement park and an abundance of music festivals. Gehry's wildly experimental building, shimmering in vivid gold, silver, red, purple and blue, colors inspired by guitar finishes, dominates the landscape.

Just inside the entrance a towering 40-foot kinetic sculpture made of 600 guitars, keyboards and drums welcomes visitors. Video kiosks equipped with remote-control knobs beckon everyone to pluck some of the automated instruments poking out from the sculpture.

From there visitors can bang on the psychedelic Jam-O-Drum-cum-lightshow or watch videos of Bo Diddley vie with Little Richard for the title of godfather of rock and roll. After comparing the sound of the white Fender Stratocaster Jimi Hendrix played at the Woodstock festival in 1969 with Byrds guitarist Roger McGuinn's 12-string Rickenbacker, they can trace rock's family tree from its blues roots up through hip-hop and punk via Bob Dylan, Janis Joplin and Eric Clapton. After playing "Wild Thing," onstage visitors can teach themselves a tune on keyboards, guitars and electronic drums, using computer tutorials, as bass shakers built into the floors literally vibrate the ground beneath their feet. They can remix the Eurythmics' anthemic song "Sweet Dreams" on a professional sound mixing board. There's a massive 65-by-40-foot LED screen showing videos; an intimate theater for master classes; a nightclub to showcase local and touring bands. There's even a wild ride called Artist's Journey, where the audience is strapped in for a motion-platform ride that drops them into the middle of a filmed block party. The ride then whooshes them into a concert audience getting down with funkmeister George Clinton and his band. "It's like something you might see in a theme park, but instead of a spaceship shooting over craters of lava, we're giving people a peak experience in a cultural area," explains Allen.

The museum is divided into five separate sections in various stages of meltdown.

To enhance the museum experience, in a technological breakthrough driven by Allen's determination to plug visitors into as much information as possible, museumgoers are given a magic wand, a handheld multimedia device equipped with a small screen, headphones and a four-megabyte computer hard drive so each person can call up an unprecedented amount of music and text on virtually every object on display. The objects can be bookmarked like a Web browser, and visitors can follow up their tour by mining the motherlode of musical history, audio and video clips in the museum's Electric Library, drawing on one of the largest computer servers ever built. Even after they've left the museum, visitors can access their bookmarked material at the EMP Website, an exhaustive resource in itself (www.emplive.com).

Beneath the quaintly nostalgic, Jetsons-era Space Needle, Experience Music Project is about as quiet an architectural statement as Hendrix's ear-piercing feedback on "The Star Spangled Banner."

Essentially a massive envelope of curving concrete blown over wire mesh and wavy steel ribs, the museum is divided into five separate sections in various stages of meltdown, each covered by an ornamental roof shell, or "skin," as Gehry calls it. Two of the sections are covered in aluminum—one painted a fire-engine red

EMP's "A Team" gives white glove treatment to "A" artifacts (opposite, from left): Peter Blecha with Clapton's "Brownie"; Jim Fricke with "Renegades of Funk" staff; Ann Farrington with a fragment of Jimi Hendrix's guitar, smashed and burned at the 1967 Monterey festival; Jon Kertzer with Big Jay McNeely's tenor sax; Andrea Weatherhead and Chris Bruce brandish '60s vintage street signs. The shape of EMP (above) emerges during construction from the vantage point of the Space Needle.

The Guitar Gallery presents the "Quest for Volume" and focuses on 55 vintage guitars, beginning with a 19th-century Italian model, and following the instrument's development as it got larger, went electric and became the signature instrument of rock and roll.

and the other a robin's egg blue. The remaining sections are stainless steel—one finished in mirrored purple, one in brushed silver and another in bead-blasted gold. Composed of some 21,000 eccentrically shaped shingles, the iridescent metal canopy buckles, bends and flows like a dozen overlapping waterfalls. There is little question that EMP is Gehry's most far-out concoction to date.

"I want people to get high without substances when they look at it," Gehry explains in his Santa Monica, California, offices.

The 71-year-old Gehry, the white-haired, cigar-chomping iconoclast renowned for the Guggenheim Museum in Bilbao, Spain, prefers Haydn and Coltrane but immersed himself in Hendrix's wailing guitar licks to help him translate rock and roll into architecture. He sought inspiration by chopping up used guitars into pieces and studying them with his guitar-playing colleagues, Craig Webb and Jim Glymph. The eclectic Gehry also gleaned color from Bosch and Vermeer paintings, jumbled roughness from Rauschenberg collages and ornate detailing from the column capitals of Istanbul's Hagia Sophia cathedral.

"Look at the folds in these robes," he instructs me as we pore over a book of angels from Dijon by 14th-century Flemish sculptor Claus Sluter. "See any similarities?" he asks rhetorically, impishly raising his eyebrows and bringing the photographs alongside the undulating tucks and creases of the EMP model.

In early conversations with Gehry, Allen said he wanted a building that was "swoopy." "Swoopy?" the architect playfully replied. "That's not an architectural term I'm familiar with. Why don't you come to my office and point out a project of mine that you think is swoopy?" he suggested.

"When Allen got here, he picked out this," says Gehry, as he slides out of his chair and walks over to a silvery, undulating model of a conference room for a German bank under construction in Berlin. "That's the best thing I've ever done in my life. It was like, man, I could just keep going in the same direction."

"There were a couple of instances where Jody and I reined Frank in a bit," Allen recalls, "but there were more cases where we said, 'Make it more rounded or swoopy or outrageous. We're talking about guitars with feedback here, Frank!'"

Using CATIA, a sophisticated system of three-dimensional computer modeling initially conceived for French Mirage jet fighters, Gehry's team was able to ensure that the building's radical curves and soaring ribs would stay up. Since there is hardly a right angle in the building, each steel rib had to be individually tooled to connect at odd angles with other supports. Without CATIA modeling, says Gehry, the idiosyncratically "swoopy" design would have been impossible.

In Seattle, reaction to the building has been mixed. The city council and the mayor were dumbfounded when Gehry's finished model was unveiled but were ultimately won over by the design commission that had earlier approved the plans. Irate local critics lambasted it as "the blob," "open

heart surgery" and worse. Both Allen and Gehry play down the virulent attacks. "There are always people who would prefer to have a square box," says Allen, "but rock and roll doesn't fit into a square box."

Breaking out of boxes has defined Allen's career from the start. For the teenage Allen, hearing Hendrix was as much a revelation as being introduced to his first computer. From the moment he first heard "Are You Experienced?" he decided to shift from classical to electric guitar. He may not have slept with his guitar as Hendrix did, but he became almost as passionate about practicing as he was about toying with the newfangled computer terminal at Seattle's Lakeside High School with his buddy Bill Gates.

In 1991, when Allen saw an auction catalogue advertising the sale of the high-crowned black felt hat Hendrix wore on his "Smash Hits" album cover, he jumped at the chance. Buying Hendrix's hat, along with record albums and other artifacts, was a way to revisit his own musical awakening.

"We opened the box and went, like, wow!" recalls EMP executive director Patton in her Bellevue offices. "The power of the artifacts was astounding. Paul said if I get a charge out of them, surely other people will, too." From the initial impulse to share the Hendrix aura, the project rocketed off into an ambitious exploration of musical creativity using rock and roll as the launching pad.

"Paul's motivation is to provide a place for people to discover the things that excite them," says Patton. Allen and Patton want museumgoers to emerge from EMP with the awareness that making their own music is well within reach. All along, Allen has relied heavily on advice from rock innovators Dave Stewart, Robbie Robertson, Peter Gabriel and others who have made breaking down the barriers between performers and listeners a crucial part of their careers.

From the beginning, Allen and Patton decided to focus on the music rather than the lifestyles of the musicians. "People were concerned that the museum might be seen as glorifying sex, drugs and rock and roll," observes Patton. "But we're not condoning any lifestyle choices; we're dealing with the musicians and their contribution to the American music scene."

At the same time, EMP curators did not want to censor or sanitize the sexual, political and social rebellion that has defined and energized rock from its earliest roots in blues and protest music to nihilistic punk and grunge. "You can't talk about race music and not mention racial discrimination," says multimedia director Jon Kertzer. "You can't talk about '60s rock and not bring up drug use."

While the museum has devoted a gallery to Hendrix and maintains an exhaustive archive of Hendrix memorabilia, Allen's ever-growing collection of musical instruments and audio equipment, records, original lyric manuscripts, costumes, posters and album cover art ranges across the history of rock. Among the 1,200 pieces selected from the 80,000-object collection for the opening are the world's first electric bass, Hank Williams' Jumbo Gibson guitar, an Elvis Presley '50s black leather jacket, a harmonica

Bob Dylan played in the '60s folk revival, the audio mixing board from Hendrix's Electric Lady studio, Eric Clapton's "Brownie" guitar from the "Layla" album, hip-hop artist Afrika Bambaataa's satin cape—and of course the Hendrix hat that started it all.

Apart from auction houses, the curators scoured flea markets, attics and garages around the country for key pieces. One of Kurt Cobain's guitars was spotted in a local pawnshop. The "Wheels of Steel," hip-hop deejay Grandmaster Flash's iconic turntables, turned up in a closet in his mother's house on Long Island.

In addition to landmark rock "artifacts," the museum is chock-full of multimedia, video and film, some gleaned from archives, but much of it specially commissioned for the exhibitions. From hip-hop concerts staged in Harlem to interviews with Les Paul, Chet Atkins and other pioneers, and recording sessions with veteran studio players like bassist Carol Kaye and guitarist Brent Mason, the EMP staff is painstakingly documenting rock's past and present.

A monorail whooshes through the "canyon" wall of EMP. Originally built for the 1962 World's Fair, the train still takes visitors from downtown to Seattle Center.

In the emerging EMP building, Kertzer and Ann Farrington, exhibits director, give me a preview. We begin in the Guitar Gallery, where visitors switch on their handheld audio guides to hear sounds from an 1834 Martin acoustic, a 1936 Audiovox electric bass, a 2000 Parker Fly, and 52 other guitars and basses, as well as narrative about the instruments. The displays include photographs of the guitars' inventors, text explaining how the various designs originated, and touch screens providing access to still more information about guitar manufacture and construction.

"The theme of this exhibit is the search for volume," Kertzer explains, "how the rise in popularity of big band jazz, for instance, forced inventors to come up with louder guitars."

In the nearby Hendrix Gallery, the rocker's white Woodstock guitar is flanked by a shard from the guitar he smashed and burned at a concert in Monterey, a kimono he wore for a performance in Newport, California, and a video screen with blues musician John Hammond explaining how the guitarist got his big break in London. Visitors also listen to selections from Hendrix's own blues collection, recordings that influenced his musical evolution. A multimedia touch-screen presentation of Hendrix's handwritten lyrics leaps ahead three decades, with music by P.J. Harvey and Metallica and others, who, in turn, drew inspiration from Hendrix to etch their own riffs on the blues period.

In his Santa Monica, California, studio, architect Frank Gehry shows off the final model for EMP, one of 100 models made during the design process.

"We're trying to gather the gestalt of audio, film and artifacts in one place," Kertzer explains. "We want people to become more educated listeners, so they can see and hear the connections among musicians that they might not otherwise be aware of, to understand that there would not have been a Prince if there hadn't been a Hendrix or a Hendrix if there hadn't been a Muddy Waters."

Chronologically, the next exhibit, the Milestones Gallery, traces the origins of rock and roll from its roots in gospel, rhythm and blues, and Western rockabilly, Farrington explains. As dancers jitterbug on a movie screen and a burbling Wurlitzer jukebox spins out 45-rpm records from the '40s and '50s, visitors amble through a room of curving bright-red walls covered with albums and photographs of everyone from Fats Domino to Chuck Berry. Bo Diddley's square scarlet-red guitar vies for attention with blues legend Big Jay McNeely's screaming tenor sax. With his audacious syncopations, McNeely injected a blistering brashness into emerging rock. On a video screen, McNeely blushes as he explains how watching the luminescent "costume" of a hoochie-koochie dancer glitter under black lights inspired him to paint his signature "honking" sax in eye-catching fluorescent colors.

Farrington, who designed exhibits for the United States Holocaust Memorial Museum in Washington, D.C. and the Newseum, a Rosslyn, Virginia, museum devoted to journalism, finds the most daunting aspect of the project is capturing music in a museum setting. "Our primary subject matter is not objects, it's sound," says Farrington. "Maximizing the visitors' ability to focus on the music, and at the same time, have them move through such a richly embellished textual and visual environment has been enormously challenging."

Part of that challenge has been sound bleed from one exhibit space to another and from headphones within each exhibit. It doesn't help that the rough concrete ceiling and exposed steel ribs—intended to make

"If we can help people become better listeners, their world will change."

an aesthetic statement about the urban grittiness of rock and roll—are exceptionally effective reflectors of sound. Because the unusual curved shapes of the steel and concrete cause so much reverberation, acoustic engineers had to devise new techniques to deaden the sound in some places and encapsulate it in others.

Following the rock origins gallery, the next exhibit spotlights Bob Dylan, Janis Joplin and Eric Clapton at decisive junctures in their careers, then-

the exhibit begins with the early Seattle music scene where Quincy Jones, Ray Charles and prerock crooner Bing Crosby got their starts. It continues past the FBI file investigating the Kingsmen's 1964 song "Louie Louie" for obscenity, and then into grunge territory—Kurt Cobain and Nirvana, among others.

Viewed straight up during construction, this soaring concert hall named Sky Church fulfills Jimi Hendrix's dream of a place where people could gather to appreciate music.

skips ahead to punk and hip-hop highlighted by a flashy graffiti-covered subway car suspended from the ceiling. To those who object that huge chunks of rock history are being ignored, Kertzer responds: "We're not trying to be comprehensive; we're focusing on the turning points."

Downstairs, a giant doorway shaped like a clown's head, salvaged from Moe, a local rock club, frames video images introducing the Northwest Passage exhibit. With narrations by musicians, producers and critics,

"We're not establishing a cut-off point," Farrington explains. "The last portion of the Northwest gallery is presented as if you're walking past a poster wall right now in downtown Seattle." Throughout the museum, Farrington says she plans to change 20 percent of the exhibits per year, rotating in completely new ones every five years, except for a few pivotal pieces that will remain in place.

Upstairs we walk into an entirely new kind of museum setting—Sound Lab, an area devoted to visitors creating music on their own. Farrington ducks into a pitch-black, soundproof room about 8 feet wide and 10 feet long. When she speaks, her voice booms forth as if we were inside a cavernous rock arena. She pushes a button on the wall and her voice sounds as though we were in an intimate concert hall. A third button push shrinks her voice to normal timbre.

Unraveling the mystery, Farrington explains that the room has speakers and microphones concealed in the walls that add reverberation as if you were mixing a record. "Each room has an electric guitar, a bass and acoustic drums so people can jam and pretend they're performing live onstage or in a recording studio," she says.

In addition to the dozen performance rooms, there are platforms with hands-on mixing boards, computer tutorials and electronic instruments with frets and keys that light up to tell you where and when to play them. A singing program encourages experimentation with voice sampling. Waiting in line for a crack at "Wild Thing" and their five minutes of fame, rock hopefuls get a glimpse of life backstage as they view a time-lapse film of Elton John's stage crew preparing for a concert and hear interviews about the grueling routine of the roadies.

At the top of a broad staircase flanked by gold, blue, yellow and silver walls that ripple by like waves sits a mirrored stainless steel pod that museum staffers jokingly call "Frank Jr." A chip off the old EMP block, Sound Lab's demo theater, which resembles a curvaceous spaceship hovering above the main entrance foyer, will host visiting performers.

"Throughout Sound Lab, we're trying to shorten the distance between rock stars and novice musicians," project manager Andrea Weatherhead explains later. Like an astonishing number of EMP's designers, Weather-

mingo, wing and ed lee
surfers/restaurateurs

mingo: after the first wahoo's caught on, we wanted to open some new restaurants. but nobody would take a chance on these surfer guys.

ed: dom and merrill said we do see it down the road, so we'll jump in and partner with you guys.

wing: it's not just about lending us money. dom's put us together with people in our industry to share ideas with and with the right people at merrill to help us grow the business.

wing: he did make one questionable decision, though. he took up golf instead of surfing.

"they saw past the shorts and t-shirts"

dom alvarez
duffer/financial consultant

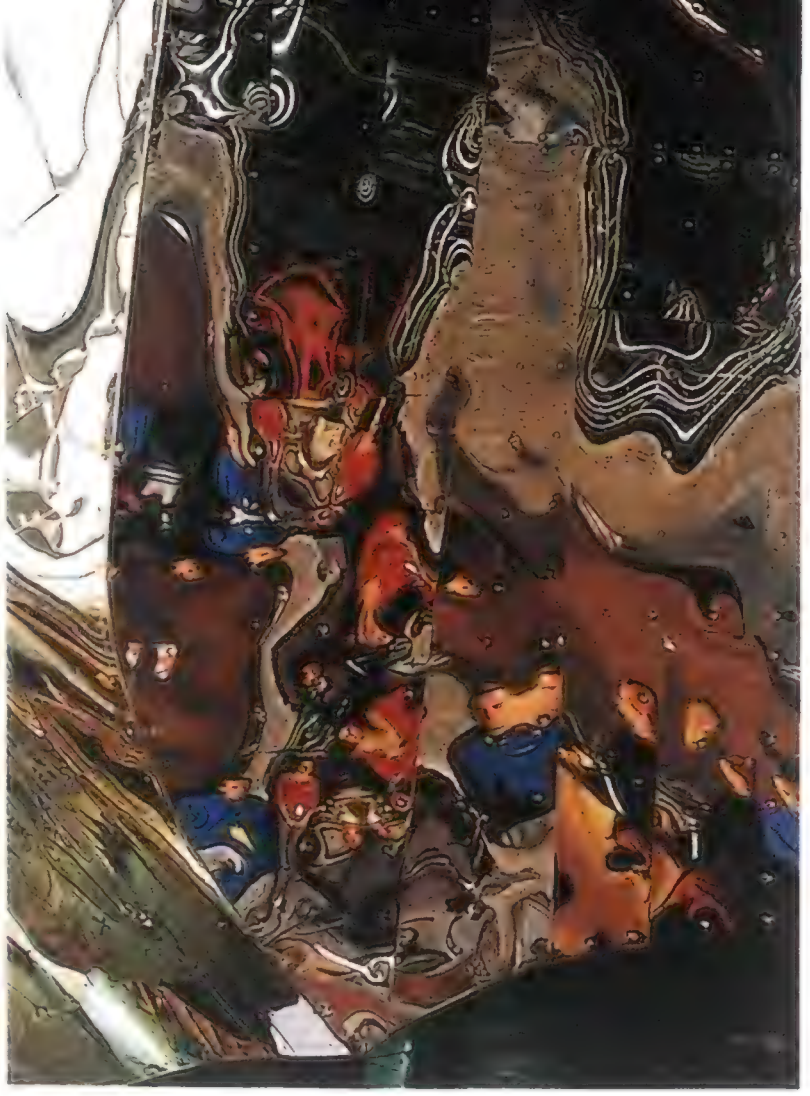
dom: don't let the surfer dude thing fool you. these guys are good businessmen.

they've gone from 1 restaurant to 13. we put together a plan for their personal finances, too, and they've gone from, well...interesting... to a place where they've all got healthy retirement plans.

i think their dad, who's also a client, must be happiest of all. he no longer has to use his house as collateral on their loans.

be bullish

Merrill Lynch



The underside of a performance space near Sound Lab is covered in mirrors, giving distorted images of visitors below.

head has played music professionally and is zealous about eliminating the fears and misperceptions surrounding music-making. "You may not be able to teach people how to play like Hendrix in three minutes," she continues, "but you can certainly train them to become critical listeners. The next time they hear a drum solo, they'll be able to identify a high hat sound. If we can help people to become better listeners, not just in music but also in their daily interactions, they will collaborate better, create more readily, sharpen their perceptions, and their world will change."

Turning on novice musicians is the driving force behind Artist's Journey, a motion-platform ride that mixes futuristic technology from *Titanic*'s special effects wizards with concerts by James Brown, Herbie Hancock and George Clinton, among other funk and jazz greats.

Taking a break in his trailer from filming one of the portions of the 18-minute ride film being shot in Los Angeles, producer Michael Caldwell explains the dizzying scenario. Strapped into their seats, audiences will feel as if they are on a roller coaster as hydraulic lifts move the floor beneath their feet and the 70mm film projected on a 120-degree screen envelops them. The audience follows two aspiring young musicians as they jump through a swirling gate into a block party set into irresistible motion by James Brown.

Not James Brown as he appears today, at age 67, but the singer at a youthful 37, when he created funk. In a groundbreaking technique using infrared photography, Digital Domain, the special effects studio, captured the precise movements of Brown's face and scanned them into a computer, creating a face with lips, eyes and pores that look and move like the godfather of soul of nearly three decades past. The computer-generated face was then virtually grafted onto the filmed image of a younger performer who dances while Brown's voice sings the funk.

"With a computer monster or space creature, there is no real counterpart for comparison, but everyone knows what James Brown looks like," Caldwell says. Besides, the digitized face will have to look realistic when blown up to 30 times life-size.

In one panoramic scene, multiple cameras sweep across 300 extras, 75 dancers and 30 musicians, landing at last on the two wannabe funk stars as they play their hearts out. The 70mm camera then follows them on a wild slide through the "funkhose," a psychedelic dream sequence of a tornado filled with flying guitars, keyboards and stage lights that deposits the boys onstage with a regally robed George Clinton and the all-stars of the P-Funk band as waterfalls of light spill and whirl around them.

"If the boys want to take the artist's journey, the truth is, it's a scary process," Caldwell explains. "We want the audience to ride the music along with them and feel as if they, too, have taken that frightening leap of faith into the unknown that it takes to become a true artist."

Although plans for films on other rock genres are in the works, Patton says she chose funk first because the '70s style has inspired hip-hop artists. "Plus, funk just makes you feel like getting up and MOVING," she declares in a booming voice that would do James Brown himself proud.

With a musical thrill ride, a host of cool instrumental toys to play with, demonstration workshops, endless films, videos and text to dig into, a restaurant, a store and a nightclub, EMP has one major headache.

"We do worry that people may never leave," says Allen. "Maybe we'll have to limit the time visitors spend playing the instruments. It's a big challenge for us." According to projections, EMP is expected to draw from 800,000 to a million visitors a year.

But Allen and Patton are already looking to the future.

"We think that EMP can be a model for a new kind of learning institution," says Allen. "Whether it's in science or other creative arts, you could apply tools similar to what we've developed for EMP to unlock people's imaginations."

But I'm not waiting for the next project. It's time to drum my way to stardom—till closing time at least. "Wild thaang, you make my heart saang, you make everythang grooovy." *Boom-boom, boom-boom. Clang!*

Paris-based Richard Covington wrote about Beirut in April. New Yorker Steve Gottlieb specializes in architecture and people.

WORLD'S
TRAVEL & LEISURE 11 CONDÉ NAST TRAVELER
BEST

Ministry
of
Crucial Decisions

Africa and the world over: Please be assured that as you travel to the world's most exotic destinations, our famously elegant, unfailingly friendly style of service will always travel with you. Aboard the Floating Utopian Society of Crystal Cruises, you will discover that no luxury is overlooked, and even the smallest request is honored with an exacting attention to detail. When you sail with Crystal Cruises, you'll agree: *It's* a WONDERFUL world.

CRYSTAL CRUISES

For information, please call your travel agent. Or call 1.800.820.6663 for a free brochure. Visit us on the Web at www.crystalcruises.com.

Chardin composed his eccentric 1775 pastel self-portrait with the same care he lavished on the arrangement of objects in such works as *The Cut Melon* (opposite). Exhibited in the Salon of 1761, the still life is noted for its unusual shape and arresting use of light.

THE 18TH-CENTURY FRENCH ARTIST CREATED A BEGUILING OEUVRE OF PORTRAITS, STILL LIFES AND GENRE SCENES

BY PHYLLIS TUCHMAN

THE QUIET MASTERY OF

JEAN-SIMÉON CHARDIN

In 1766, Catherine the Great commissioned a painting for the lecture hall of the Academy of Fine Arts in St. Petersburg from the French master Jean-Siméon Chardin. But when the canvas, *The Attributes of the Arts and Their Rewards,* arrived in Russia, the empress was so dazzled by the inventive composition that she decided to keep it for herself. The artful still life features a paint-daubed palette complete with knife and brushes, a plaster cast of a statue of Mercury, books, coins, a ewer, a portfolio of drawings and a black ribbon with the cross of the Order of St. Michael, all arranged in a rhythmic composition of form and color.

By the late 1770s, the mighty Catherine, a renowned Francophile, owned five exceptional pictures by Chardin. She had a remarkable eye: all of them were included in the seminal retrospective of the artist's work that opened in Paris in 1979. Seen also in Cleveland and Boston, it was the first comprehensive Chardin exhibition mounted by museums in the 200 years since the artist's death.

The Russian sovereign's taste and discrimination are again apparent in the splendid Chardin exhibition opening at the Metropolitan Museum of Art in New York on June 27, after crowd-pleasing runs in Paris, Düsseldorf and London. This time, paintings from Catherine's collection, as well as the Minneapolis Institute of Arts' variant (opposite) of her *Attributes,* will be on view along with some 60 other works representing a career that spanned five decades. Unlike other established artists of his time, Chardin, in the days before photographic reproductions, often painted multiple versions of his successful panels and canvases. These works have always been among the most discussed of his career. Writing about one of the later versions of *Attributes*, no less than the incomparable Denis Diderot—the mastermind behind the *Encyclopédie* and an art adviser to Catherine the Great—declared in 1769: "While looking at . . . 'Attributes of the Arts,' the eye is soothed and remains satisfied and at peace. When one has looked at this piece for a long time, other pieces appear cold, two-dimensional, commonplace and crude. Chardin is between nature and art; he . . . is an old sorcerer from whom age has not yet stolen his magic wand."

In the scores of still lifes and genre scenes to be displayed at the Metropolitan, viewers can see evidence of the virtuosity that elicited Diderot's enthusiastic response. Chardin's works convey his warmth, charm and reserve. He portrayed children with the tenderness of a doting grandparent (though he never became one himself) and caressed color onto the contours of fruits as if he were a Dean or Deluca. Unlike his contemporaries, he ignored frivolity and intrigue, depicting instead the simplicity of everyday life. In his works, common objects and scenes are rendered with dignity and seriousness, and the humdrum becomes beguiling. For Philippe de Montebello, the Metropolitan's director, Chardin is "a pure painter whose subject is almost subordinate to the joy of painting."

The minimalist compositions of Chardin's small-sized pictures—some measure less than 7 by 9 inches—belie their complexity. As novelist/culture czar André Malraux said in 1951, "Chardin is not simply a little master of the eighteenth century who is more refined than his rivals. . . . His quiet mastery overthrew the baroque still life of Holland and made mere decorators of his contemporaries."

How Chardin did what he did remains a mystery. He never revealed his technique. It was said that he worked on one canvas or panel at a time, and that each painting could take him several months to complete; that he layered his colors, applying his paint in rapid brushstrokes, often using his thumb; and that he used models and preferred to paint what he knew. About the version of *Attributes* in the Minneapolis Institute of Arts, Samuel Sachs II, that museum's former director, commented, "This is a still life on a scale reserved for portraiture. It is a portrait of everything important to the artist who painted it." This sensibility is a leitmotiv in Chardin's art.

Jean-Siméon Chardin, a stay-at-home, was born in Paris on the Left Bank in the rue de Seine on November 2, 1699. His world never grew much larger. Besides being baptized at the nearby church of Saint-Sulpice, he would twice be married there. The house in the rue du Four where he next lived with his parents and, later, with his first wife, is also in the sixth arrondissement, as was the home he shared with his second wife, around the corner in the rue Princesse. Except for a brief time spent in Fontainebleau in 1731 to help restore some 16th-century wall paintings, Chardin seems never to have left Paris. He died there in 1779 at the age of 80.

Among his colleagues and contemporaries, Chardin was an exception. Both François Boucher and Jean-Honoré Fragonard, like other winners of the Prix de Rome, traveled to Italy. Antoine Watteau visited London, and the peripatetic Voltaire lived in Prussia, England and Switzerland.

Chardin did not become a cabinetmaker like his father. Instead, he

P. 80 MUSEE DU LOUVRE, PARIS P. 81 HERVÉ LEWANDOWSKI/PHOTO RMN

The original version of *The Attributes of the Arts and Their Rewards*, with its plaster cast of sculptor Jean-Baptiste Pigalle's celebrated *Mercury*, was painted for Catherine the Great in 1766. The version above, now in Minneapolis, was likely painted for Pigalle.

MINNEAPOLIS INSTITUTE OF ARTS, WILLIAM HOOD DUNWOODY FUND

studied with two respected history painters, now practically forgotten, Pierre-Jacques Cazes and Noël-Nicolas Coypel. By 1724 the young man was admitted as a master painter to the Académie de Saint-Luc on the basis of two multifigure compositions: a signboard for a surgeon, for which several friends posed; and an anecdote-filled scene of a candlelit billiard party, complete with posted police regulations. Chardin clearly knew his cushions from his cues. His father specialized in billiard tables, even making several for the king.

Throughout his life, Chardin painted the familiar. His panels and canvases are filled with everyday objects, many from his own home—kitchen utensils, tables, chairs, carpets, clocks, goblets and covered bowls. Both of his wives sat for his genre scenes, as did friends and acquaintances. Chardin owned the plaster copy of sculptor Jean-Baptist Pigalle's *Mercury* featured in *The Attributes of the Arts and Their Rewards*. And he constantly passed, in the rue de Grenelle, Bouchardon's fountain with its sculptural allegory of Paris, which appears in an earlier painting. Almost all his titles, however, were generic. When, for instance, during his 70s, he rendered pastel portraits of himself and his second wife, he nearly always displayed them simply as "studies of heads." He apparently felt that further information was extraneous to the work of art.

Small in stature, but strong and muscular, Chardin, according to Diderot, was witty and "had spirit and . . . a great store of good sense." His talent and ambition were already evident in the elaborate still lifes he painted

shortly after 1724. These feature dogs and cats eyeing partridges, hares and fish on tables laden with foodstuffs. Two of these works, *The Buffet* and *The Ray*, earned Chardin a citation from the prestigious Académie Royale de Peinture et de Sculpture as "a painter skilled in animals and fruits." In 1728 he was received as a member of the Académie at the tender age of 28.

The Ray, on display for the first time outside Paris, features copperware, ceramics, a corked bottle, a tenuously placed knife, opened oysters, a raw carp, a rumpled cloth and an animated cat. Hanging on a stone wall and dominating the scene is the ghostlike eponymous image of the fish. Overly cluttered by today's standards, the picture has been copied by countless modern artists. Paul Cézanne sketched its right side during the late 1880s. Henri Matisse's full-sized homage dates from 1896. "Yes, I often go to the Louvre," Matisse said in 1913, during Cubism's height. "I mainly study the work of Chardin there. I go . . . to study his technique." After Chardin was rediscovered in the mid-19th century, a number of major painters early in their careers, including Manet, Monet and Vuillard, appear to have drawn inspiration from his motifs and methods.

Among the first group of paintings Chardin displayed at the Salon du Louvre when it resumed in 1737 was *Girl with Shuttlecock*, which was created that same year. In this work, Chardin portrays his young subject with remarkable delicacy and sympathy.

PRIVATE COLLECTION

In the late 1720s, Chardin courageously began paring down the compositions that had brought him attention. Instead of continuing to paint the sort of ornate, sumptuous still lifes popularized by the Dutch masters, he created works that are as subdued and spare as those of the early Spanish still-life artist Juan Sánchez Cótan. Upon stone shelves, Chardin placed just a few pieces of fruit and a bottle or goblet. Even the pictures with rabbits, other game and sporting gear—bags, powder flasks, guns—changed. They are not hunting pictures, just as Jean Renoir's classic film *Rules of the Game* is hardly the story of a hunting party. Both artist and director focus on relationships—and on startlingly accurate depictions. As Sachs, now director of New York's Frick Collection, said not long ago, "Chardin's imagery is meant to be touched by the eye. It's not just about the skill of the artist. Fur feels like fur." Under natural illumination, such as the skylights of the Kunstmuseum in Düsseldorf, one could see how the artist applied his pigments as if he were modeling a sculpture from clay or wax.

By 1730, Chardin was receiving important commissions, including five pictures for Count Conrad-Alexandre de Rothenbourg, the French Ambassador to the Court of Spain. Two of these, *Musical Instruments and Parrot* and *Musical Instruments and Basket of Fruit*, will be in the Metropolitan show. Prefiguring Catherine the Great's *Attributes* by three decades, the pair reveal Chardin's knack for composing shapes, textures and colors into visual rhythms.

In his early genre masterpiece, *The Washerwoman* (1733), Chardin artfully rendered the peace and silence of this domestic scene. His figures—their gestures static—seem to inhabit their own separate worlds, creating a sense of discreet intimacy.

Success enabled the 31-year-old Chardin in 1731 to marry 22-year-old Marguerite Saintard, his fiancée of eight years. Within a year, they had a son, Jean-Pierre, a future painter who would win acclaim as a history painter, study in Rome and ultimately drown in a canal in Venice, an apparent suicide. A daughter, Marguerite-Agnès, was born in 1733, but died just a few years later.

For the following two decades, Chardin painted genre scenes that conveyed the nature of life "upstairs, downstairs" as few others have. The artist's wife, it is believed, posed for one of the earliest such genre pictures, *Woman Sealing a Letter*, which was exhibited in the 1737 Salon du Louvre and was the first of many to be reproduced as an engraving by other artists. Chardin subsequently supplemented his income with "royalties" from such reproductions. But while charming, these prints, executed in black and white, highlight by its very absence the artist's gift for color. Wrote Diderot, "This magic defies understanding. It is thick layers of color applied one on top of the other. . . . At other times, you could say it is vapour that has been breathed onto the canvas."

NATIONAL MUSEUM, STOCKHOLM

One of the artist's more elaborate still lifes, *Partridge, Bowl of Plums and Basket of Pears* is reminiscent of works by the Dutch masters. Distinguished by its rich color, skillful use of space and subtle highlights, the painting dates from Chardin's pre-1730 period.

No one is certain why Chardin stopped painting still lifes and started producing genre scenes, or why he later returned to still lifes. One explanation, at least for the former, centers on an apocryphal story involving the portrait painter Joseph Aved. Allegedly, a woman who had asked Aved to portray her wanted to pay less than he thought he deserved. Even though he was not busy, he rejected her offer. Chardin urged his friend to change his mind because the fee was good for a relative unknown, as they both were at the time. "Yes," Aved cheekily replied, "if a portrait were as easy to do as a sausage"—an allusion, of course, to Chardin's still lifes. Supposedly to disprove this notion, Chardin began to paint family and friends, including Aved (p. 88). Yet he did not title the picture for which his colleague posed *Portrait of Aved*. Caught deep in thought, the figure was exhibited alternately during Chardin's lifetime as a chemist, a philosopher and an alchemist.

In other pictures, scullery maids, cooks and washerwomen return from market, draw water, peel turnips. One servant tries to get whites whiter. Children, rather than pursuing their studies, take games from drawers, blow bubbles, build houses of cards and spin tops. These little adults are scene stealers. An enchanting young girl, whose features seem to bear a resemblance to those of Chardin's first wife, holds a badminton racquet in one hand and a shuttlecock in the other. As the son of one of Chardin's friends turns a top in another picture, we watch him watching. Notes Montebello, "Part of the poetry in Chardin is the silence of his pictures. He captures and holds the moment for eternity."

In 1735, shortly after the artist depicted his wife stirring a cup of steaming tea, a symbol of the transitory, she died at the age of 26. Chardin, who by all accounts was devoted to her, was bereft. It was not until 1744 that he wed Françoise Marguerite Pouget, a wealthy, childless widow of 37. The marriage thrust Chardin solidly into the middle class. The couple had one child, a daughter, who died in infancy.

By this time Chardin's collectors included his monarch (Louis XV), the royalty of Prussia and Sweden, and various counts, cardinals, ministers and ambassadors from across Europe.

DeVille DTS

&

20/20 Foresight.

The future can be the split second between you and the unexpected. Minimize the surprise factor with the DeVille DTS. DeVille offers the responsive technology of the Northstar System. The intuitive control of StabiliTrak 2.0. The enlightenment of LED taillamps. And the guidance of OnStar.* All meticulously crafted within an inspirational design. Making the unexpected nearly obsolete.

THE POWER OF &

THE FUSION OF DESIGN & TECHNOLOGY

Experience DeVille's intuitive technologies. Visit cadillac.com or call 1.800.333.4CAD.

*One-year OnStar premium contract is standard. Call 1-800-ONSTAR-7 for system limitations and details.

©2000 GM Corp. All rights reserved. Cadillac® Cadillac badge® DeVille® Northstar® StabiliTrak® OnStar®

Chardin's portrait of his close friend the painter Joseph Aved was displayed at the 1737 Salon as *A Chemist in His Laboratory* and later shown under the title *A Philosopher Reading*. Its imposing volume and use of half-light recall the work of Rembrandt.

Despite his lofty position, Count Carl Gustav Tessin of Sweden was humbled enough to write: "The pictures by Chardin are something to go on your knees before. . . ."

When Chardin returned to painting still lifes around 1750, he simplified them further. He used fewer elements, and his compositions became more austere. Often he would include items of greater value than before, reflecting his own change in lifestyle. In paintings such as *The Cut Melon*, the objects seem closer to the viewer. The overall design has become more abstract, as his forms appear to rise and fall, billow and recede. Curves echo one another and continue to reverberate. When the colors of fruits and flowers are reflected on porcelain and silver surfaces, the painter conveys the tenderness of two people touching. As Diderot exclaimed, "Oh Chardin! It is not white, red or black that you grind on your palette: it is the very substance of your subjects: it is air and light that you dip your brush into and transfer and attach to the canvas."

About his own art, Chardin had little to say. "One uses colors, but one paints with feeling," he was reported to have observed. While he painstakingly rendered what he saw, year in and year out, he well understood that the magic and mystery of art comes from the ineffable.

In September 1752, Chardin was awarded the first of several royal pensions for his accomplishments. He was also put in charge of the hanging of the Salons after 1755 and served as the treasurer of the Académie Royale, taking that venerable institution from debt to surplus. In 1757, the artist and his wife moved to royal apartments in the Louvre, just across the Seine from his childhood home.

As his eyesight weakened during the 1770s from the fumes of his paint, Chardin could no longer work with oils. Never known as a draftsman, he mastered working with pastel on paper. The best known are his self portraits. Marcel Proust once likened the artist's appearance in the portrait in which he wears an eyeshade (p. 80) to that of an eccentric, elderly English tourist. With his face close to those of his viewers throughout this series, Chardin—with a twinkle, a nod and a proudly turned lip—eloquently sums up his lifetime in the arts. Growing old, he suggests, you will know joy, sorrow, honor, disappointment, wonder, love and glee.

Phyllis Tuchman has written for Smithsonian *on artists George Segal and Jackson Pollock.*

How do you know you're getting the right financial advice?

At American Express, we measure the quality of financial advice we provide our clients. And we work hard to ensure that the financial plan we prepare meets your approval. We deliver clear recommendations that can be acted upon and regular reviews that show progress toward your goals. So you can enjoy the confidence and satisfaction that come from working with a company that has over 100 years of investment experience. At American Express, our financial advisors are dedicated to helping you do more.

Express Financial Advisors Inc. *Member NASD and SIPC.* American Express Company is separate from American Express Financial Advisors Inc. and is not a broker-dealer. © 2000 American Express Financial Corporation. All rights reserved.

Horning In?

Bighorn sheep have made a comeback in recent years, but some developers out West think they're intruders

BY STEVE KEMPER

JOHN WEHAUSEN'S FAVORITE FIELD HAT IS SO TOUGH that its maker guarantees it for life. Wehausen is now sweating through his fourth, which suggests how much time he has spent in the field over the past 26 years pursuing bighorn sheep. Six-foot-two and rail-thin, with a wispy beard, Wehausen began studying bighorn as an excuse to wander for weeks in the mountains, but then the sheep took over his life. Now he clambers after them in California's majestic Sierra Nevada and in the scorched ranges of the Mojave Desert. Most field biologists devote a few years to researching one animal and then move on. Wehausen, scientifically speaking, has been a monogamist.

When I visited him recently at his home in Bishop, California, on the eastern side of the Sierra, I found sheep horns littering the front porch. Inside, I saw skulls with massive flared horns leaning against a living room wall. On the messy kitchen table, piles of correspondence shared space with a hefty trophy given to Wehausen by the Desert Bighorn Council for his "outstanding contribution" to bighorn science. By title, he is a research scientist at the University of California's White Mountain Research Station in Bishop, but he has no office there and works out of his house.

A Rocky Mountain bighorn ram typically curls its lip as part of mating behavior. Horn ends are damaged from fighting.

Over the next few days, I scrambled up and down the steep, rocky slopes favored by bighorn, and learned about wild sheep. I also came to understand, as I panted along behind the 50-year-old Wehausen, why a colleague refers to him as a "pair of lungs with legs."

His special passion is the Sierra Nevada bighorn, also known as the subspecies California bighorn. This is one of two groups of bighorn classified as endangered in the United States. In the past decade the Sierra population has plummeted from 300 to about 125. The other endangered population, called Peninsular bighorn, lives in the desert mountains around Palm Springs, California.

Several Indian tribes associated the thick, curled horns with big winds and rains.

Bighorn have symbolized the West's mountains and canyons since the first European explorers gawked at their vertical acrobatics, beginning with Coronado in 1540. They appear frequently in the journals of Lewis and Clark, occasionally as the main course. But Lewis admired their prowess even more than their flavor. In a badly misspelled entry for July 18, 1805, he describes a large herd "on the immencely high and nearly perpendicular clift opposite to us; on the fase of this clift they walked about and bounded from rock to rock with apparent unconcern where it appared to me that no quadruped could have stood, and from which had they made one false step the[y] must have been precipitated at least a 500 feet."

Lewis noticed that Indians fashioned the sheep's horns into cups, spoons, platters and bows. (Wehausen has come across rock blinds along sheep trails in the Sierra, where Indians crouched, waiting for bighorn.) Native Americans had venerated bighorn in rituals and stories for centuries before the arrival of white men. There's a Kilawa tale from Baja California, in which the Creator builds the sky, but it keeps drooping, so he props it up with four bighorn on top of four mountains. To the peoples of the lower Colorado River, the stars of Orion's belt are known as Three Mountain Sheep. Indians carved and painted thousands of bighorn on cliff faces throughout the West, and some ritually cremated the sheep's bones to appease the animals' spirits. Several tribes associated the thick, curled horns with big winds and rains, and wouldn't bring them into their villages, stacking them near watering holes or ceremonial sites.

Mountain sheep migrated to North America from Eurasia over the Bering land bridge more than a half-million years ago. By Coronado's time, bighorn ranged throughout the western half of North America, from Canada to Mexico, from snowy crags to desert ledges, wherever the landscape offered steep, open slopes. They once browsed river bluffs and foothills as well, but pressure from ranchers, miners and settlers confined them to the rugged terrain of mountains. In the mid-19th century, the sheep were hunted commercially; at least one menu from gold rush days listed bighorn as an entrée.

By the late 1800s and early 1900s, rams were esteemed as trophy animals among big-game hunters, some of whom wrote popular accounts of their excursions. Literary naturalists also brought the sheep to the public's attention. Ernest Thompson Seton's *Lives of the Hunted* (1901) introduced many young readers to bighorn through the dramatic story of "Krag, the Kootenay Ram." John Muir devoted a chapter to bighorn in *The Mountains of California* (1894), calling them "the bravest of all the Sierra moun

Two rams clash horns in the Canadian Rockies. During the rut, when the opportunity to breed is at stake, it can take many hours before a violent contest such as this is settled.

taineers." After watching three sheep casually climb a steep, icy slope, Muir wrote, "This was the most startling feat of mountaineering I had ever witnessed, and, considering only the mechanics of the thing, my astonishment could hardly have been greater had they displayed wings and taken to flight."

But during those same years, the bighorn was devastated by overgrazing, overhunting, epidemic diseases passed on by livestock (mainly domestic sheep) and habitat loss caused by roads, fences and towns. By the first decades of this century, the subspecies called Rocky Mountain bighorn had been exterminated in Utah, Nevada, New Mexico and Washington, as well as most of Oregon. Another subspecies, the Badlands or Audubon's bighorn, was already extinct, and others were heading in the same direction. By 1960 the North American population had shrunk to about 23,000. Most of the survivors lived in small groups isolated by the fragmentation of their traditional ranges. At that point, science got interested. Biologists began studying the sheep in earnest, and major restoration programs were initiated in several states during the 1970s. Bighorn have been returned to many of their old haunts over the past 20 years, and some groups are prospering. With an overall population now estimated at 70,000 in North America, the bighorn has become a conservation success story. (Another 100,000 to 130,000 thinhorn sheep—Dall's sheep and Stone's sheep—live in Alaska and western Canada.) The sheep have benefited from better science, better conservation and management practices, and the financial sup-

Bighorn like steep, open ground where their agility and eyesight can protect them.

port of groups such as the Foundation for North American Wild Sheep, which thus far has pledged $10 million for a project to restore up to 6,000 bighorn to prime habitat in Idaho's Hells Canyon.

Yet uncertainties cloud this magnificent creature's future. Many herds remain small and vulnerable to catastrophic die-offs triggered by disease or weather. In 1995, for instance, an epidemic reduced Washington's Rocky Mountain sheep by more than half, to fewer than 200, and the herds in Idaho have plummeted. Colorado's sheep population has rebounded to about 7,000 in recent years, but the animals are scattered in 66 isolated herds. By comparison, Wyoming's 6,500 sheep make up just 15 herds. But even in that wide-open state, which has the country's smallest human population and its largest concentration of bighorn—about 700 in Whiskey Basin—the population has declined in the past decade by about 12 percent.

Using radiotelemetry, biologists Stacey Ostermann and Jim DeForge track Peninsular bighorn in the Santa Rosa Mountains south of Palm Springs, California.

Throughout the West, wild sheep are feeling pressure from development and the presence, in some areas, of domestic sheep, plus predation by mountain lions and encroachment by forests. Bighorn like steep, open ground where their extraordinary agility and eyesight can protect them, but years of fire suppression have allowed trees to overgrow much of their former habitat. Many wildlife biologists are now calling for controlled burns to reestablish old territory and open up traditional migratory routes.

The ups and downs of bighorn conservation are starkly illustrated by the sheep Wehausen studies. As soon as I reached Bishop, he took me to Wheeler Ridge in the Sierra, to see what he calls "drive-up sheep"—bighorn visible from a country road. He looked at the immense, steep mountainside for a few minutes and then casually announced, "I see sheep." Despite his precise directions and my good binoculars, it took me a while to find them. They blended perfectly into the mottled landscape of gray rocks, dun ground and dusty bushes. It was a group of nine ewes accompanied by a few lambs "and one 2-year-old male," added Wehausen, after studying the age rings on the latter's horns with a spotting scope.

The sexes don't mingle much except at rutting time. Young males stay with the females for about two years, quickly developing their lifelong habits of strutting and butting. They then join a band of rams, where they are often butted, kicked and even mounted by older, stronger males. Young rams devote their lives to butting their way up the chain of dominance until the happy day when they too can bully other males and rut themselves silly.

Among rams, horn size is all. It determines the only two things that matter to them—their rank in the hierarchy and their chances of mating. A well-fed young male can add four or five inches to its horns each year; a Rocky Mountain ram's may curl nearly four feet, and its skull, including horns, can weigh more than 30 pounds.

At mating time, rams chase females up and down the slopes or hang around the local watering hole to round them up. Older rams do everything possible to keep younger ones from breeding.

And then there's the fighting. Rams joust most seriously during mating season—Wehausen listened to one contest that went on for 24 hours. "They pretend that they're feeding, but they're really watching each other," he says. "And then they'll suddenly turn and go at it. It's such a *crack*, like a rifle shot. You can hear it a long way."

There is what appears to be an almost ritualistic aspect to these clashes. The rams rise up on their hind legs, then smash heads. Immediately afterward, they step back, freeze and, with heads raised at a slight angle, appraise each other's horns. By comparing the force of the impact with the size of his opponent's horns, a ram can get a pretty good idea of his own. That gives him some indication of whether he is evenly matched or in way over his head, so to speak.

CHAD [illegible]

Surrounded by bighorn skulls, researcher John Wehausen works in the office of his cabin near the snowcapped Sierra, where he spends much of his time studying sheep.

The fights can be vicious. Horns take such a beating that the tips are usually broken off, or "broomed." At the conclusion of the mating season, Wehausen has seen more than one ram with its face nearly skinned from getting hit so often by glancing horns.

The strongest rams with the biggest horns tend to die sooner (at 7 to 11 years) than their less well endowed rivals—probably because they burn out from chasing females and fending off upstart males. The rams' parental involvement ends with the rut. Ewes drop their lambs in the spring. Within days, the young mountaineers learn to scamper up and down steep slopes.

Gray foxes, bobcats and golden eagles are capable of taking a bighorn lamb; wolves, grizzlies and mountain lions have the strength and athleticism to kill big sheep. Wehausen has seen a mountain lion make a successful attack. "A once-in-a-lifetime opportunity," he says. At dusk in the Sierra, he heard small rocks falling and lifted his binoculars to see a group of panicked bighorn scrambling toward the mouth of a canyon. Behind them bounded a mountain lion. Most of the sheep climbed to safety higher on the canyon side, but one 120-pound ewe stopped on a narrow ledge. The lion pounced onto the ledge and balanced there just long enough to bite the ewe in the neck before its momentum carried them onto a sandy flat below, where the lion finished the kill.

Predators must work very hard to nail a bighorn. Even predators with rifles find the sheep eerily elusive. So do field biologists. While chugging behind Wehausen on sheep trails littered with scat, I often thought about a sentence from the 1916 journal of naturalist Charles Sheldon: "... tracks were numerous but sheep were scarce." Wehausen says matter-of-factly, "They evaporate." He has suddenly lost them even from the vantage of a helicopter: "We'll turn around and they've just disappeared."

Over the years, hunters—who sometimes pay hundreds of thousands of dollars for a chance to bag a ram—have fabricated some tall stories to explain how bighorn escaped them. One common tale claims that when the sheep get caught at the edge of a precipice, they dive off and land on their horn-encrusted heads, then trot off unharmed. John Muir dryly wondered how ewes survived this, with their

small, spiky horns, and noted that even if a ram's skull didn't crack from such a fall, the rest of his bones would.

Bighorn hearing is mediocre, but the sheep have several other things going for them. First, they live on the open perpendicular, which protects them against attack by most predators. They have a good sense of smell, and their eyesight is superb. It's hard to surprise them, especially if lambs are present or it is windy. Wind unnerves bighorn because when brush is moving, they cannot detect dangerous things prowling through it.

The country-club ways of the endangered Peninsular bighorn sometimes prove fatal.

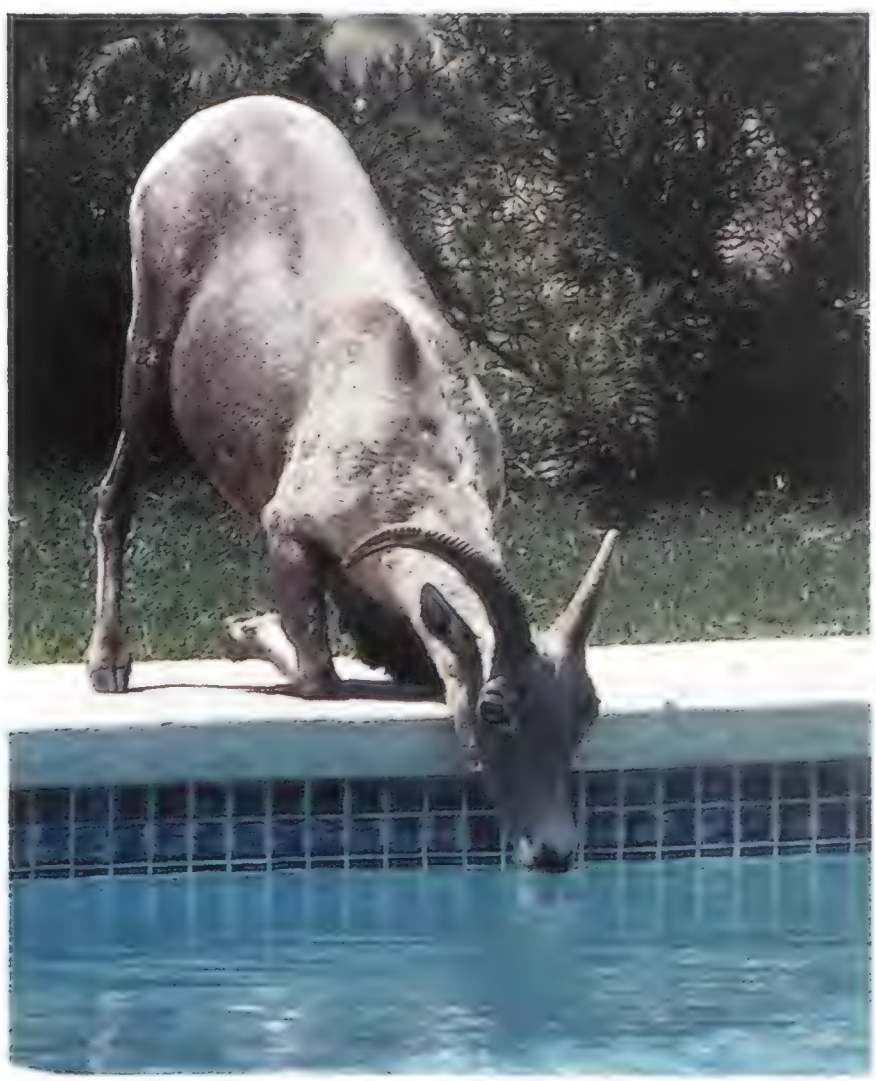
Yet for all their skittishness, they *are* sheep, and sometimes will domesticate to a degree. In his pioneering work, *Mountain Sheep* (1971), wildlife biologist Valerius Geist wrote that some bighorn got so used to him, they would rush up and put their noses into his pockets to lick the salt he carried as a treat. Wehausen has seen bighorn begging along the roads in Glacier and Banff National Parks, and has a photograph of a panhandling sheep sticking its head inside his car window.

There's an extreme example in Palm Springs, where the country-club ways of the endangered Peninsular bighorn sometimes prove fatal. Jim DeForge, a founder and the executive director of the Bighorn Institute in nearby Palm Desert, drove me to a gated community of million-dollar mansions at the foot of a mountain. We immediately spotted six bighorn grazing on the manicured common. Four big rams came clopping down the street, heading for the same sweet green. DeForge groaned. "That's sad to us," he said. "That's *not* bighorn sheep. But most of these places are used as second homes, so they're often empty and the mountains are close behind for safety. The sheep say, 'Hey! Ice cream! Let's go down!'" DeForge has pictures of them drinking from swimming pools.

But this paradise can be lethal. Because the irrigated lawns are always moist, disease-carrying insects and parasites flourish in them, debilitating many sheep. Oleander, popular among local landscapers, is toxic to browsing bighorn. Then there are the cars. As we drove, DeForge mentioned that seven bighorn had been killed on this short section of the main drag, and several others injured.

Pressured on one side by mountain lions and on the other by a booming real estate market, these sheep are getting squeezed out. The population of Peninsular bighorn has dropped from 1,170 in 1979 to about 335 now. Most of those live south of Palm Springs. Only 29 adults remain nearby in the northern part of the Santa Rosa Mountains.

Signs of the times: A bighorn statue overlooks a community in California (above) that is named after the sheep whose habitat it displaces; a real ram (opposite) ponders traffic in Boulder City, Nevada; a ewe (below) drinks from a pool in California.



These sheep have been DeForge's life's work. Like Wehausen in the Sierra, he has watched in agony as their population has crashed. The Sierra Club petitioned for endangered status for them in 1991 but faced formidable opposition from developers. Though the sheep were finally declared endangered in 1998, not much has changed for them. The area has nearly 100 golf courses—more courses than sheep, DeForge likes to point out—but new ones are being proposed all the time. Developers routinely sue or threaten DeForge's small nonprofit group for pointing out that their projects will eradicate still more habitat.

Fortunately for the sheep and DeForge, many local people like bighorn, or at least the idea of them. Walk into any souvenir shop and you'll find the sheep's image on T-shirts, mugs and golf balls. Bighorn sculptures adorn city parks and expensive lawns. Rancho Mirage, an affluent area 11 miles southeast of Palm Springs, supports the Bighorn Institute financially, a policy that was challenged recently by developers but approved overwhelmingly by the town's residents.

On the other hand, house lots in the area are selling for up to $1 million an acre, and new golf-resort communities are creeping up the mountainsides. One developer bulldozed hundreds of acres in Palm Desert, named the community Bighorn and stationed a number of sheep statues at the entranceways. If development continues at its present pace, the only bighorn around will be statues.

Aside from field research, DeForge's institute operates a captive-breeding facility that has released 77 bighorn into the surrounding mountains. For his part, Wehausen views captive-breeding as an option of the last resort. He believes the future of Sierra Nevada bighorn rests mainly on translocation, taking a number of sheep from one place where they are doing well and moving them to another place. He is also committed to controlling mountain lion predation—a major undertaking, it turns out. Since last fall, three two-man teams have been working full-time to identify and eliminate problem lions in sheep-recovery areas. Ultimately, a dozen or so cats will be radio-collared and monitored; any found killing sheep will be shot. Similar measures are being taken in several other Western states.

The track record of bighorn restorations is spotty. Scientists from several state and federal agencies recently finished a seven-year study in and near 15 national parks, and found that nearly 60 percent of the restorations failed—the sheep either declined or disappeared. "That's the lowest percentage among big ungulates, which are usually easy to translocate," says Francis Singer, the study's principal investigator. When translocated populations crash, says the report, the main culprits are overcrowding and the proximity of domestic sheep, which pass on lethal infections

Wehausen has noticed several differences between high mountain bighorn and desert sheep.

such as bronchopneumonia, usually through stray domestic sheep or roving bighorn rams, for whom any ewe will do. Such diseases can wipe out entire herds. But this hazard is waning along with the demise of the domestic sheep industry. In the late 1930s, 45 million sheep grazed the mountains of the West. Today there are only 4 million.

Singer's study lists three requirements for successful restorations: a group of at least 25 sheep; a patch of suitable habitat big enough to sustain the herd's growth; a distance of at least 12 miles from domestic sheep.

Wehausen knows as much about bighorn as anyone, yet he believes that much remains undiscovered or misunderstood. Even the taxonomy is unsettled. Biologists have assumed for decades that the species *Ovis canadensis* contains seven races ranging from Rocky Mountain sheep in Canada to desert sheep in Baja California. But new genetic research by Wehausen and his colleague Rob Ramey may reduce the number of subspecies by half.

Bighorn have disappeared from the arid land west of Death Valley where these Indian petroglyphs portray them. The drawings are from 500 to 1,000 years old.

Since the mid-1980s, Wehausen has been driving 300 miles to the Mojave every three weeks in spring, less often the rest of the year, to monitor herds on Old Dad Mountain and in the Marble and Old Woman ranges. "To my knowledge," he says, "I am one of very few sheep researchers who have ever had the privilege of studying both high mountain and desert bighorn."

On one of his trips, we drove up a sandy track after dark and unrolled our sleeping bags beneath the big desert sky. The next morning we climbed into the Marbles, volcanic mountains colored red, gray and ocher, with splashes of black desert varnish. We followed thin trails made by bighorn over loose rocks, which clattered down the steep drop-offs. The footing was treacherous, and some of the scree slopes reduced me to all fours.

It was April, usually the greenest time here, with new grass and tasty wildflowers everywhere, but nothing was blooming, nothing was green. Wehausen called it one of the worst droughts in 15 years. "There's less to eat for the ewes, less milk for the lambs," he said. "I expect very few lambs to survive until summer."

Wehausen has noticed several behavioral differences between high mountain bighorn and desert sheep. Necessity drives desert bighorn to disperse more widely for forage. They spook easier, perhaps because few people enter these inhospitable mountains. Wehausen has found unexpected differences even within neighboring groups of desert sheep. Ewes from the Marbles have emigrated to other ranges; Old Dad ewes rarely stray. Most desert groups eventually visit the water tanks put up by wildlife officers, but one group in the Marbles doesn't drink at all, relying solely on the moisture within forage—for instance, the juicy insides of barrel cactus. Wehausen's assistant once saw two rams butting heads over an open one, alternately taking bites as their mouths passed back and forth over the pulp. He's also seen blood on barrel cacti and spines hanging from sheep's faces and horns.

After several hours in the Marbles, Wehausen spotted a single ewe about 300 yards below us, already dashing away. "I have to go down and see if she left any droppings," he said. As we walked, he had periodically scooped up the ubiquitous droppings and rubbed them between his thumb and forefinger, then put his nose into his cupped hand like a connoisseur of gourmet coffee. "Nuggets of information," he said, grinning. He was testing for freshness, as a clue to the sheep's movements. Down below, we found the ewe's scuff marks in the gravel slope, and a big pile of fresh pellets.

"This is *gold*!" gushed Wehausen. He carefully put them into a bag, which he would add to his collection of similar bags dating back to the 1970s. That's when he began ana-

COURTESY BIGHORN INSTITUTE; JEFF FOOTT

Brain Teaser

How do you improve your child's reading skills even before she learns to read?

How can split-second improvements in the way children perceive sounds dramatically speed learning?

If you go to the gym to exercise your body, where do you go to exercise your mind?

Find the answers at BrainConnection.com.

Devoted to understanding the brain and enhancing learning, BrainConnection.com presents the latest advances in neuroscience, including products that actually train the brain to learn faster. Students using these products can improve reading skills in just weeks, instead of years.

brain Connection™

Visit BrainConnection.com, a Web resource from Scientific Learning Corporation. Or call 888-452-7323.

For 30 seconds, they watched us, and then cantered single file around a bend.

lyzing fecal samples for their nitrogen content, which reflects the nutrition and digestibility of the sheep's diet. "I have the best collection in North America," he said. "It's *so* valuable." The reason: it's now possible to extract DNA from droppings. Wehausen and Ramey hope to identify the genetic makeup of all the adults in his Sierra Nevada study areas and then sample the lambs every year to see how many rams, and which ones, are breeding. They'll be able to tell if inbreeding is becoming a problem, and if necessary they'll import a ram to spice up the gene pool.

We scrabbled up and around. At every new vantage, Wehausen stopped to glass the rocky mountainside. After seven hours without glimpsing another sheep, he decided to call it a day, and we began to descend through a canyon. Of course that's when we saw a group of six on a ledge 200 yards above us. For 30 seconds they watched us watching them, the natural aristocrats of the heights, and then cantered single file around a bend. Wehausen climbed to see if they had left any gold in them thar hills.

A precocious lamb demonstrates its agility, bounding across steep terrain. Youngsters must contend with predators, disease and sometimes malnutrition from poor forage.

Waiting for him, I wondered: Doesn't it get tedious driving 600 miles every three weeks? Doesn't it get stale working on the same animal for 25 years? Wehausen said no. He doesn't tire of bighorn because something unusual always happens to lure him on, like that year's severe drought. He wants to see how it affects survivorship and reproduction—he wants the data.

"I see people study something for three years and then draw conclusions," Wehausen explained, "but I could take *any* three years of my data and the conclusions from it would be incorrect or incomplete. We don't have many long-term data sets like mine. I've tried to build predictive models and not one has ever worked, because ecology is so complicated."

The sheep keep surprising him. In the mid '80s, all five Sierra Nevada herds abandoned their normal winter ranges at about 5,000 to 7,000 feet and began wintering as high as 12,000 feet, apparently to escape mountain lions. The snows were deep, the forage poor. The change startled Wehausen. According to the literature, bighorn were creatures of almost inflexible habit, and yet here were five independent populations responding quickly and radically to a new threat.

Unfortunately that change led to poorer nutrition, which caused the ewes to postpone lambing from late April to early June, so they could strengthen themselves first on spring forage. This delay meant one month's less nourishment before the lambs faced the Sierra winter. Add to that the poor forage on the higher winter ranges, and the result was a high mortality rate for lambs.

"I was watching my life's work being destroyed," said Wehausen, as we stood at the base of Wheeler Ridge in the Sierra, watching sheep. He was feeling a bit better about this particular herd at the moment. In 1999, for the first time since 1985, most of this group returned to its old winter range at 7,500 feet, where the forage is better. They returned again this year. In 1995 the herd was down to 18 sheep, but since then the mountain lion population has been significantly reduced here. Wehausen figures there are more than 50 sheep now. "This group is our hope for the future," he says.

The next day Wehausen took me to Tioga Pass, high in the Sierra. He spotted two rams silhouetted on a rugged ridge far above us. Lofty, regal, remote, they transformed the skyline, charging it with vitality and mystery. When they vanished, the landscape dimmed a little.

Steve Kemper has written 11 stories for SMITHSONIAN, *most recently on beluga whales and poisonous creatures.*

W. PERRY CONWAY

MEET AAGE KRISTIANSEN: This Swedish scientist, trained at the renowned Gothenburg Technical Institute, joined Tempur-Pedic in 1989 at a critical time—when building the first weightless sleep system (with promising but unperfected aerospace materials) seemed impossible. Aage discovered the formula that saved the company's Tempur® project from abandonment. His colleagues were euphoric! He was hailed as the "father" of the Tempur-Pedic revolution, which has fundamentally changed the way people sleep. Aage now lives in Sarö, a small coastal village 20 kilometers south of Gothenburg.

You've read about it, heard about it, wondered about it. Now here's an opportunity to find out about it: the miracle bed that will energize your life with the magic of weightless sleep!

Our advanced technology is recognized by NASA, the U.S. Space Foundation, and certified by the Space Awareness Alliance.

SPACE

Now millions can enjoy a new kind of sleep because

THIS SWEDISH SCIENTIST WENT UNDERCOVER AND MADE YOUR MATTRESS OBSOLETE.

He used NASA research to invent our Weightless Sleep System™!

AAGE KRISTIANSEN is the scientist who turned NASA's experimental anti-G-force cushioning into a sleep-science breakthrough: the Tempur-Pedic Swedish Sleep System™.

Still sleeping on a dinosaur?

Our bed is the *future*. Conventional beds are obsolete. Others are fancy on the outside. Ours is a MIRACLE ON THE INSIDE. Trillions of viscoelastic memory cells act as molecular springs (see cut-away photo) to cuddle your body—pressure free.

Enjoy up to 83% better sleep.

The thick padding that covers other mattresses keeps the steel springs inside but creates a hammock effect outside—which causes pressure points. Tests show that Tempur-Pedic cuts nighttime tossing and turning by up to 83%!

Fits both you and your spouse.

Our extraordinary Tempur® material uses body mass and temperature to *adjust* to your shape and weight yet gives total support. Its microporoscopic structure self-ventilates to dissipate heat. Also, our new AirFlow™ system assures even greater comfort.

Only one moving part—*you.*

The Tempur-Pedic bed uses no electricity, no compressed air, no heated water. Natural principles of physics give you the indescribable "lift" of weightless sleep. No settings or controls to adjust…no heaters, motors, or air pumps to break. You do absolutely nothing but lie down on it!

FREE DEMONSTRATION KIT is now yours for the asking

Rave reviews in the press!

TV, radio, magazines, newspapers …our bed wins wide acclaim. DATELINE NBC told all America about Tempur-Pedic. Ditto CNN's BUSINESS UNUSUAL, CNBC's POWER LUNCH, Discovery Channel, Newsweek, Business Week, Associated Press, and many others.

Health professionals say 'Yes!'

Our owners *love* weightless sleep and the way it eases aches, pains, and back problems. Thousands of sleep clinics and health professionals recommend Tempur-Pedic!

Try it for 13 long weeks.

We'll set up a brand new bed in your bedroom (even remove the old bedding). Sleep on it for 3 FULL MONTHS. If you don't love it, we'll pick it up and take it back—entirely at our expense!

…This bed makes all others obsolete™!

- *Free setup/removal*
- *Direct-import prices*
- *Shipped duty-free*

Custom sizes made to order
The miracle is on the inside!™
Viscoelastic memory cells conform to every curve and angle of your body, ventilating windows dissipate heat.
Tempur® material molds to your body!™
LIMITED 20 YEAR WARRANTY

TEMPUR-PEDIC®
PRESSURE RELIEVING SWEDISH MATTRESS AND PILLOW

FREE SAMPLE/FREE VIDEO/FREE INFO

1-888-461-5055

OR SEND FAX TO 1-859-259-9843

Tempur-Pedic, Inc., 1713 Jaggie Fox Way, Lexington, KY 40511

© Copyright 2000 by Tempur-Pedic, Inc. All Rights Reserved

for the love of

MUSTA

ACROSS THE CONTINENTS, THE MARKET FOR THIS FASHIONABLE CONDIMENT IS BOOMING

BY JOSEPH A. HARRISS

ENTICED BY THE FRAGRANT WHITE smoke wafting down Mount Horeb's East Main Street from an outdoor grill covered with sizzling bratwursts, I accept a free hot dog from a friendly man in a bright-yellow T-shirt. Then comes the hard part: what to put on it. Eschewing mustards on the table, such as Bertman's Ball Park, Plochman's Spicy Peppa, Mamma Rap's Garlic and French's Classic Yellow, I opt for a hearty dollop of Mike's Magic Mustard. "You'll like that one," promises Jim Thompson, the man in the T-shirt and proud creator of this blend of mustard flour, two kinds of mustard seed, red wine vinegar, whole eggs and sugar. "Welcome to National Mustard Day!"

Munching the dog—I find Mike's Magic, like many of today's new mustards, a tad sweet for my taste—I head past yellow-haired Skippy the Clown and a five-foot-tall French's squeeze bottle that waves at me, and enter the Mount Horeb Mustard Museum. I quickly see why this small Wisconsin town just west of Madison has become

PHOTOGRAPHS BY BROOKS WALKER

Canada's fields supply more than 90 percent of the world's export demand for brown and white mustard seed: both kinds of pods are shown above.

A portrait of Antoine Claude Maille, founder of a venerable mustard-producing firm, graces the interior of the company's boutique in Paris.

the epicenter of America's burgeoning mustard mania. Jars of the stuff in all shapes, sizes and colors fill the show window, line the walls and stack on display tables. Mustards from more than 40 countries, from Italy to Iceland and Belgium to Brazil, are on display here, along with a handsome collection of crockery, porcelain, silver and crystal mustard pots. "One of our rarest is a mustard powder from Kathmandu, Nepal," says Barry Levenson, a puckish former lawyer in the Wisconsin Attorney General's office who created the museum-cum-boutique in 1992. "In all, we've got about 3,400 varieties of mustard. As far as I know, that makes this the world's largest collection." People send him mustards they find during their travels, such as a jar from Sri Lanka that Wisconsin State Chief Justice Shirley Abrahamson brought back. Besides the collections behind glass, some 500 kinds of mustard are on sale here. That includes, believe it or not, chocolate fudge mustard that is made in—where else?—California.

Today is the first Saturday in August, making it National Mustard Day according to Chase's Calendar of Events, which keeps track of noteworthy moments in our nation's life. Dozens of mustard aficionados crowd around tables laden with open jars, plunge plastic spoons into them and solemnly compare. One taster, a state corrections officer with a jet-black Vandyke beard, tries one labeled Royal Bohemian XXX, screws his eyes shut and concentrates on the growing glow on his tongue. "Good God, that's hot," he pronounces. "I've gotta have it. The garlic one is really good, too. So many flavors, so little time." Nearby, a brawny guy in shorts and running shoes tries a jalapeño mustard: "Whooeee, that really opens the sinuses!" One lady from Rhode Island picks up some jars (cranberry, key lime) for her mother, while another, from Baltimore, goes for raspberry honey mustard and Inglehoffer Extra Hot. Wearing his Captain Mustard costume of yellow tights, leotard and black cape for the occasion, Levenson gives his

of creamy yellow paste is spreading across American platters and palates.

explanation of mustard's newfound diversity and popularity: "It's cheap and easy to make, which makes it ideal for people who want to start up their own small businesses and cottage industries. And for consumers, it's a very affordable luxury."

No doubt about it, mustard's on a roll in America. With mustard seed now the world's most heavily traded spice, an unctuous river of creamy yellow paste is spreading across American platters and palates. In the current trend to bolder, more piquant flavors in American meals—witness the popularity of spicily exotic cuisines from Tex-Mex to Thai, Cajun to Szechuan—mustard is also well ahead of other traditional flavorings like red pepper, sesame, paprika, cinnamon, oregano and basil, according to the American Spice Trade Association. Overall sales of sauces, condiments and dressings, which totaled $7 billion in 1998, grow steadily every year. A sizable chunk of that is mustard, updated and transformed into myriad modern modes that seem to go with everything. It's all as if gourmand Americans have come to agree with 16th-century English poet Thomas Tusser's recipe for good cheer: "Good bread and good drink, a good fier in the hall, / Brawn pudding and souse and good mustard withal."

Among the literally thousands of mustards now on offer are flavors including lemon peel, tarragon, chives, ginger, peppercorn, peanut, black olive, dill and pineapple, with essence of kitchen sink surely not far behind. You can even sneak in a tipple while spreading on mustard made not only with the traditional white wine but also with sloe gin, real ale, cognac, whiskey, Guinness stout or champagne. "It sometimes seems that in the United States a new mustard product is being marketed every week," says John Hemingway, a globe-trotting British mustard consultant based in Norwich, England, with an encyclopedic knowledge of the subject. "Cottage-industry specialties and regional styles now compete with new aromatic varieties from the big producers. You can hardly keep up with it."

One reason: it's a perfect fit with today's lifestyle, a condiment that indisputably, ahem, cuts the mustard. It contains virtually no cholesterol. Its emulsifying qualities make it an essential part of everything from salad dressings and mayonnaise, to baked beans and barbecue sauce. Mixed into industrially prepared foods, it not only adds flavor but gives them a longer shelf life by inhibiting the growth of molds and bacteria; meat products like hot dogs and bologna have better texture and slice more easily when made with mustard flour as a binding agent.

Mustard's new diversity is much on view at the annual Napa Valley Mustard Festival, held January to March in locales like St. Helena, Yountville and Calistoga, California. Though almost no condiment-quality mustard seed is cultivated in the valley, the spring fields are ablaze with mustard in bloom; the plant is used as a cover crop in many vineyards to prevent erosion and to enrich the soil when plowed under. When some 248 mustards from seven countries were judged by tasters last year, the grand champion was Robert Rothschild Raspberry Honey Mustard, made by a small firm in Urbana, Ohio. Runners-up were a motley bunch of mustards including roasted chipotle, smoky garlic, apricot ginger and Sea Dog Beer. Another star at the festival was Russian Sergei Lyapin, who brought a load of Sarepta mustard from a 190-year-old firm in Volgograd, 300 miles south of Moscow. Lyapin hopes his spread, with the bite and consistency of horseradish, will find its niche in America's wide-open, $300 million mustard market.

To be sure, that market is still largely dominated by the bright-yellow spread that has festooned American hot dogs since it, and the hot dog, were introduced at the St. Louis World's Fair in 1904. French's Cream Salad mustard was the creation of George Dunn, the plant superintendent for George French. Canny New York State mustard makers at the turn of the last century, French and his brother, Fran-

Parisian window-shoppers admire a selection of mustards displayed at the Maille boutique at Place de la Madeleine, the city's district of gourmet purveyors.

Pliny the Elder used mustard seed in a poultice for snakebite.

Millstones are still used to grind seeds at Raye's Mustard Mill and Museum in Eastport, Maine. The mill has been in continuous operation since 1903.

cis, figured that Americans weren't consuming as much mustard as they would like because it was, well, hot. Heat might be what furriners liked about mustard, but French knew his compatriots' predilection for blandness. His milder variety, whose bright-yellow color actually comes not from mustard seed but from added turmeric, was right on target: the company made a million dollars by 1915, and by 1926 it had sold out for a tidy $3.8 million to an English food products company.

Today, French's processes more than 30 million pounds of mustard seed a year at its plant in Springfield, Missouri, and its ubiquitous jars and squeeze bottles account for nearly one-third of the U.S. market. Its Classic Yellow, as Dunn's creation is now called, is used by 69 percent of American households in any given year. The company also produces a milder version of Dijon-style mustard (which it promises to be safely free of "ooh, la, la spiciness," and "as American as apple pie"), along with four other varieties, including deli style, honey, sweet onion and horseradish blends. It regularly creates and publishes recipes for busy cooks, such as seashell pasta salad, deviled eggs and guacamole chicken wrap. "Women today don't have a lot of time to spend on preparing meals," says Janet Andreas, who runs French's test kitchen and works up such recipes. "With mustard they can add a creative touch to simple meals put together with everyday ingredients."

America's infatuation with mustard has led to dozens of Websites run by small specialty and regional mustard makers hawking their wares. Mustard flowing via the Internet is one measure of how far the spice has come since the days of Alexander the Great, who once used it as a sort of primitive telegraph during a battle in 331 B.C. Alexander figured he would knock off the Persian Empire in an easy afternoon's work, but Persia's cocky emperor, Darius III, sent him a saucy warning: a bag of sesame seeds symbolizing how numerous his troops were. Alexander coolly replied with a similar bag—but filled with much more numerous mustard seed to show not only the number of his warriors but their hot ferocity as well. Alexander won.

All the great ancient civilizations, from Greece and Egypt to China and India, cultivated and consumed mustard seed. The Greek dramatist Aristophanes wrote in the fifth century B.C. of mustard-spiced stews, while Pythagoras, perhaps looking for ways to help people remember his theorem about right triangles, held that mustard improved memory. Bronze Age sites in Greece and Anatolia have yielded the seed; Indian and Sumerian texts going back to 3000 B.C. mention it.

The ancients held that mustard was good, and good for you, if not a virtual panacea. The Greeks credited Aesculapius, son of Apollo and god of medicine, with creating it. Dioscorides, the first-century A.D. Greek physician whose *De re medica* was the standard pharmacological text for centuries, prescribed mustard for everything from swollen tonsils to epilepsy, and as a tonic against "feminine lassitude." The Roman scholar Pliny the Elder ground mustard seed with vinegar and used it as a poultice for snakebite and scorpion stings, while the Greek physician Hippocrates favored mustard poultices for treating bronchitis, pneumonia, rheumatism and neuralgia—ample precedent for today's folk medicine remedy of a mustard plaster for many of the same ills.

How we look at every Five Star dealer.

Dodge

Now there's a process that puts dealers and their dealerships under the microscope so you don't have to. Five Star—an innovative certification process that totally redefines the way cars and trucks are sold and serviced. • This 21-point process scrutinizes every aspect of the car-buying experience. It looks at what each person in the dealership does, how they do it and, most important, how they can do it better. • Take a closer look at a Five Star certified Chrysler, Plymouth, Jeep® or Dodge dealer. You'll really like what you see—but only where you see the Five Star sign. **Five Star. It's Better. We'll Prove It.**

CHRYSLER
Plymouth
Jeep

For more information, call us at 1-800-677-5-STAR or visit www.fivestar.com. Jeep is a registered trademark of DaimlerChrysler.

In medieval Paris, hundreds of hawkers trundled wheelbarrows of mustard

Persian noblemen, they say, used to show off their swordsmanship by putting a mustard seed on a block and slicing through the minuscule orb with a single stroke of their scimitar. No mean feat when you consider that a brown seed is only 0.064 inches in diameter, and it takes some 26,500 of them to make one jar of Dijon mustard. That's why Saint Matthew, when searching for a metaphor to show how powerful even a tiny bit of faith is, wrote, "If ye have faith as a grain of mustard seed, ye shall say unto this mountain, Remove hence to yonder place; and it shall remove: and nothing shall be impossible unto you."

We know the Greeks and Egyptians chewed mustard seeds with meat, probably to disguise its gamy taste. But it was the Romans who used it most widely and creatively, mixing it with vinegar, honey and oil, and pickling meats with it. Lucius Junius Moderatus Columella wrote of mustard in his 12-volume reference work, *De re rustica*, giving detailed recipes for making the condiment with such ingredients as saltpeter and hot coals.

Each year, on the first Saturday in August, the town of Mount Horeb, Wisconsin, just west of Madison, is the site of the National Mustard Day street festival.

It appears that the Romans also gave us, at least indirectly, the condiment's name. Savants disagree, as they will, over the origin of the word "mustard," but the consensus seems to lie with the Latin *mustum* because the condiment has often been prepared by mixing with unfermented grape juice, or must. Add the Latin *ardens*, "hot" or "fiery," and you have it. But some hold for a Celtic derivation from *mwstardd*, meaning "something that emits a strong odor."

The conquering Romans carried mustard seed to their province of Gaul, where it took root and formed the basis of France's traditional preeminence in mustard making—and consumption. By the ninth century, French monasteries were already making a good revenue from their mustard preparations. In 1336, the Duke of Burgundy supplied no less than 70 gallons of it for a single day's feasting.

In medieval Paris, hundreds of hawkers, wearing blue aprons and red caps, trundled wheelbarrows of mustard through the streets, housewives popping out their doors for a daily refill. French king Charles VII fortuitously discovered a new mustard recipe in 1422 while fighting the Hundred Years War. Blowing into the village of Sainte-Menehould in eastern France between battles, he demanded dinner, but most local cupboards were bare. Finally one obliging housewife threw together what she could find: four pig's feet. She prepared them in a batter of breaded herbs and mustard sauce. The king was delighted and *voilá*, a traditional French recipe was born, *pied de cochon á la Sainte-Menehould*. His successor, Louis XI, also was fond of mustard but feared being poisoned. Solution: the king always carried his own personal mustard pot with him when he traveled, breaking it out whenever he appeared unannounced to dine with his subjects.

Life in the American Colonies was a rustic affair, but early settlers still added a touch of luxury with mustard. An issue in 1735 of the *South Carolina Gazette* heralds mustard seed "just imported from London by Jon Watson"; Thomas Jefferson indulged his Frenchified tastes by ordering five pounds of mustard seed from Paris and planting it in his garden at Monticello. On the West Coast, the Spanish Catholic missionary Junípero Serra, the Apostle of California, spread mustard seed along the Mission Trail, starting at Mission San Diego in July 1769.

By the mid-19th century, mustard was becoming so popular in France that gastronomic authority Grimod de La Reyniére commented that mustard had become "such a primary necessity that without it at least two-thirds of the stomachs in Paris wouldn't be able to digest." And not only in Paris. Most self-respecting French cities have had their local mustard, but France's supreme center of mus

through the streets, housewives popping out their doors for a refill.

tard making has long been the Burgundian city of Dijon. This seemed so obvious to writer Alexandre Dumas that when he stopped at the city's Hôtel du Parc for dinner one evening, he was taken aback when the waiter asked what mustard he wanted with his two lamb cutlets and half a cold chicken. "*Parbleu*," the author of *The Three Musketeers* exploded, "*moutarde de Dijon!*" But the waiter politely explained that Dijon mustard then existed in both a men's and a milder ladies' version. Dumas hesitated, then helped himself to some of both. "At just the sight of the beautiful yellow color of this admirable stimulant to appetite," Dumas later wrote, "I plunged the wooden spoon into each pot and made two pyramids of mustard in my plate." *Bon appetit*, indeed.

Located at the foot of the vine-covered slopes of the Côte d'Or hills, Dijon, former home of Philip the Bold and John the Fearless, passed in 1390 its first city ordinance prescribing how Dijon mustard should be made. And city fathers made sure it was enforced.

Dijon's purist approach to mustard making was reflected again in the ordinance of May 1634: producers had to swear before the aldermen to serve king and city well and faithfully, and perform a three-year apprenticeship under a master *moutardier* before mixing up their own batches. The strictly codified recipe for Dijon remains pretty much the same: black or brown seeds (more pungent than white) are ground and passed through a sieve. Verjuice or white wine is added to obtain a light yellow paste, then the mixture is packed into jars for shipment. No coloring, cereal flour or stabilizers are permitted.

Today France produces about 47 percent of all prepared mustard from Europe, just ahead of Germany, and exports more than 4,000 tons of it, worth some $5 million, to the United States. Dijon mustard factories like Maille, Bornier and Reine de Dijon couldn't look less like those in 19th-century photographs, where a dozen gents in mustaches and flatcaps fiddle with stone grinding wheels and oaken casks of mustard paste. Now a batch takes only four hours, from pouring seed into the grinders to pumping consumer-ready paste into sterile jars. One or two technicians can easily follow the whole mechanized process on computer screens.

The proliferation of varieties of mustard means that the major French makers are producing 50 or more kinds. Most are for the export market: straight, strong, sinus-opening mustard is by far the most popular in France. "We like the idea of a wide variety of mustards, and we have brought out 15 new flavors for our boutiques since 1997," says Jean-Denis Bellon, international marketing manager for the AM Group, which makes Maille, "but we can't go on at that rate for the retail market. We think mustard should taste like mustard. If you get too fancy, you limit the kind of food it goes with. We make honey mustard, for instance, but only for export and our boutiques. Few French would touch it."

At the Mount Horeb Mustard Museum, home to 3,400 types of the condiment, a visitor samples one version. Five hundred kinds of mustard are offered for sale here.

At the Reine de Dijon company, sales manager Luc Vandermaesen understands the trend. "The move to wider variety is here to stay," he says. "People have always mixed other things with mustard to get different flavors; now you can get something different straight off the shelf." He spends time in American supermarkets picking up mustards to bring back and analyze. "Look at this," he says indignantly as he reads the list of ingredients off a jar of American-made "Dijon" mustard. "Additives include citric acid, spices, coloring, cornstarch, sugar, liquid egg white, locust bean gum and flavoring, whatever that is. It has nothing to do with what we make here in Dijon."

Paradoxically, one thing they *don't* make in Dijon is mustard seed. "Lots of people think these are mustard plants," Jean-Denis Bellon tells me as we drive along fields of yellow-flowering plants near the Maille factory. "But

"The fruity taste of real mustard lends an elegance to many dishes."

Burgundy farmers stopped growing it years ago because they couldn't get as much subsidy for it from the Common Market as for rapeseed." At least they stay in the large and diverse mustard family, rapeseed also being a product of a Cruciferae plant. The family includes some 390 genera of plants with cruciform flowers and peppery leaves, such as radishes, broccoli, cauliflower, brussels sprouts, turnips and watercress. Ornamental mustard family members include candytuft, honesty, rose of Jericho, basket-of-gold and—oddly in the case of mustard—wallflower.

Dijon mustard makers, like those elsewhere, import nearly all their seed from thousands of miles away: the endless plains of western Canada. Unlike most other spices, mustard for export is grown mainly in the temperate zones, meaning the industrialized world. "It's a simple question of economics and climate," explains Kevin Dick, a marketing executive for Canada's big United Grain Growers company in Winnipeg. "Mustard needs the kind of long, cool summer days we have to mature, and we get such good yields here on the western plains that no other part of the world can meet our prices. The only European countries with a significant production are Britain and the Czech Republic." The 700,000 acres devoted to mustard in the country's Saskatchewan, Manitoba and Alberta provinces produce some 250,000 tons of seed per year, enough to supply more than 90 percent of the world's export needs. To keep their competitive advantage, Canadian grain companies are constantly researching yellow (*Brassica hirta*) and brown (*Brassica juncea*) mustard plants at field stations to improve yield—now about 1,000 pounds per acre—and resistance to white rust fungus and other plant diseases, and to achieve greater regularity in seed size for easier milling.

"Not many crops pay as well as mustard," says Lynn Shaw, a tall, burly farmer with a generous shock of gray hair, "and it's easygoing, tolerating extremes of weather and suffering from few insect pests or diseases. That makes it a good rotation crop to mix in with wheat, rye and oats." Like other growers, Shaw just hopes there's not another baseball strike like the one in the United States a few years ago—"the price for mustard seed always goes up when the season starts and those hot dog vendors get going." When I take a look at his crop at Gainsborough, Saskatchewan, it's easy to spot the 400 acres of mustard: a broad swath of bright-yellow flowers glows toward the horizon. Shaw bends down, plucks a hairy pod of yellow seed and pops it open. "Still green," he observes, rolling the soft little seeds between thumb and forefinger. "When they're beige-colored and the moisture content goes down, we know it's time to harvest, usually in early September." I pick a pod myself and place a couple of seeds in my mouth. The budding heat is already there and it leaves my mouth refreshed for a long while afterward.

Chef Alain Passard has created a mustard sauce to accompany artichoke hearts at his three-star Paris restaurant, Arpège.

This distinctive, palate-cleansing quality is one thing Alain Passard loves about ever-versatile mustard. "It adds a perfect touch of acidity that offsets the cloying greasiness of meat," says Passard who, as chef and owner of Paris' three-star Arpège restaurant, is one of France's greatest cooks today. He doesn't much take to all the aromatic mustards coming out now, preferring a natural flavor and color, and a silky texture on the tongue. "The slightly floral and fruity taste of real mustard lends an almost subversive elegance to many dishes like chicken or sweetbreads with mustard sauce, or a crayfish bisque," he says. "I like to add just a touch of it to many sauces for a subtle grace note that surprises diners when they discover it's mustard."

Given the confusing welter of mustards on offer today, which one to choose? The only important thing is in fact to choose wisely, rather than just grab the first jar or tube on the supermarket shelf. Variety and quality are so great now that it's worth the trouble to try several and form an opinion. Like professional mustard tasters, the rest of us might even start talking about its appealing, vinegary nose, full, smooth texture, and decently balanced flavor building to an intense, bright heat. After all, mustard has come a long way from the ballpark, baby.

Writer Joseph A. Harriss is based in Paris. Brooks Walker is a photographer who works from New York City.

"A FASCINATING look into the history of American Indians and New England."

– *The Washington Post*

A 22,000-square-foot recreation of a 16th-century Pequot village

The latest in computer interactives and touch-screen 3D graphics

Original 70mm film "The Witness" portrays key events of the 17th-century Pequot War.

CALL 1-800-411-9671 FOR INFORMATION

Located between Norwich & Mystic, CT • Exit 92 off I-95 or Exit 79A off I-395

www.mashantucket.com
MASHANTUCKET PEQUOT TRIBAL NATION

MASHANTUCKET
PEQUOT
MUSEUM
& RESEARCH CENTER

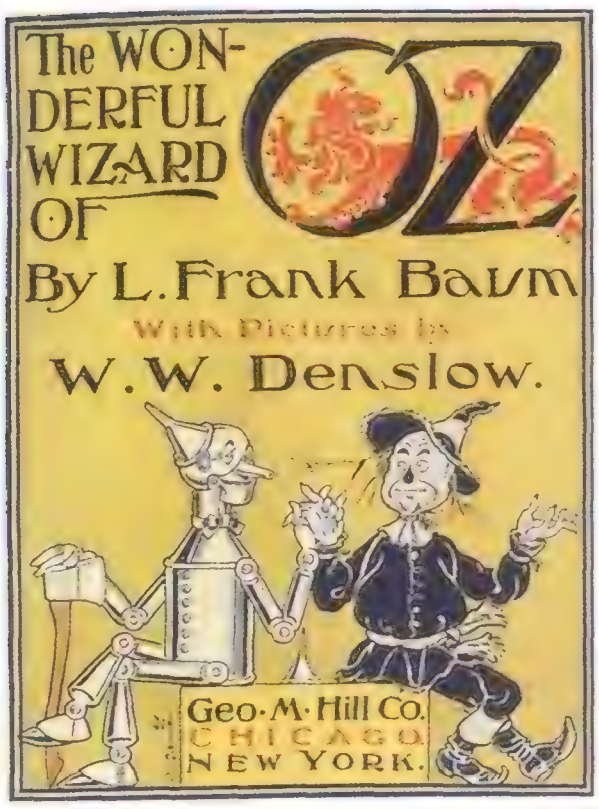
OUR LEGACY IS YOURS

The Amazing

EVERGREEN AT 100 YEARS OLD, L. FRANK BAUM'S GENTLE FABLE OF DOROTHY AND THE WONDERFUL WIZARD KEEPS HIS MEMORY ALIVE WITH MOVIE FANS AND READERS THE WORLD OVER

BY BRUCE WATSON

ALL THE CHILDREN IN ABERDEEN KNEW THE TALL, DAPPER gentleman who strolled through town each day. For a child on the Dakota Plains, life in the late 1880s sometimes seemed little more than hard work. The bleakness of the prairie cried out for a fantasy to take a boy or girl far away. Mr. Baum's stories were pure fantasy, so when he walked down the street in his finely tailored suit, children clamored in his wake.



If he had time, Baum would sit down on the edge of the dusty wooden sidewalk and gather children around him, taking one or two into his lap. Fingering his cigar, he would look above the wooden storefronts and into the big sky as if searching for a setting. Then with a smile and a twinkle in his eye, he'd begin his tale.

The Wonderful Wizard of Oz (above) appeared in 1900. The well-known film version (right) hit the screens in 1939.

Author of Oz

THE WONDERFUL WIZARD of OZ
MOTHER GOOSE IN PROSE
L. FRANK BAUM
PICTURES by MAXFIELD PARRISH
DOT AND TOT OF MERRYLAND
BY L. FRANK BAUM
PICTURES BY W.W. DENSLOW
L. FRANK BAUM
THE ARMY ALPHABET
PICTURES by HARRY KENNEDY
By L. FRANK BAUM
THE NAVY ALPHABET
PICTURES BY HARRY KENNEDY
By L. FRANK BAUM
AND HIS POPULAR
BOOKS FOR CHILDREN
FATHER GOOSE HIS BOOK
VERSE BY L. FRANK BAUM
PICTURES BY W.W. DENSLOW
AMERICAN FAIRY TALES
AMERICAN FAIRY TALES
By L. FRANK BAUM
THE SONGS OF FATHER GOOSE
For The KINDERGARTEN The NURSERY And The HOME
GEO. M. HILL COMPANY.
CHICAGO. PUBLISHERS. NEW YORK.

A publisher's poster depicts covers from a group of Frank Baum's early books for children. Featuring several illustrators, these editions appeared between 1897 and 1901.

Unlike stories told by parents, Baum's were not merely lectures in disguise. Instead, he made everyday objects—scarecrows, pumpkins, rag dolls—come alive. His stories glittered with color; whole fields were shaded blue, green or red. As he went on, Baum often seemed to lose himself in the telling. Years later, his mother-in-law, who had overheard many of his stories, urged Baum to write them down. But while living in Aberdeen, he was content to tell his tales just to please a child or two.

When Lyman Frank Baum finally did set pencil to paper, stories poured out of him. In a career of just two decades, he wrote more than 70 books. Many are long forgotten, but one was called *The Wonderful Wizard of Oz*. It's about a girl from Kansas who meets a scarecrow, a tin woodman and a cowardly—well, perhaps you know the story. But you may not know that Oz is more than a single book that inspired one of Hollywood's greatest movies. Long before TV staked its claim to children's fantasies, Oz was mapped in the imaginations of countless children. Going on beyond the wizard, Baum wrote 13 other Oz books. After he died, his successors churned out 26 more. Between 1913 and 1942, a new Oz book came out every Christmas. Oz Reading Clubs devoured each one. An Oz Who's Who charted the kingdom's colorful characters, including the Patchwork Girl, the Tik-Tok Man, Princess Ozma and hundreds more. These days, the ubiquitous MGM movie overshadows the books, but readers who choose to go there still find Oz so much more than lions, tigers and bears, oh my. Baum's fairyland is a place of childish dreams and fears, a kingdom ruled by love but haunted by fear of sudden death. It's a land where adults are as helpless as children and children are as strong as adults. Peppered with puns and wordplay, Oz is charming and altogether ambivalent about the benefits of age. In short, it's much like its creator, L. Frank Baum, the "Royal Historian of Oz."

The seventh child born to Benjamin and Cynthia Baum came not trailing clouds of glory but clouds of gloom. Three of the couple's first six children died in infancy. In 1856, Frank was born. From an early age, he seems to have suffered from angina pectoris, a heart disease causing severe chest pain. Baum's delicate condition made him a sedentary, solitary child. He read constantly, mostly fairy tales. For most of his youth, he was schooled at home. While Frank was still very young, his father developed some oil fields in Pennsylvania and made a fortune. The Baums moved to a mansion, called Rose Lawn, where Frank flourished.

At 18, he began hanging around some nearby theaters and decided he wanted to become an actor. His father tried to steer his stagestruck son from his dream but finally relented, asking only that Frank not disgrace the family name. Going by various stage names, Baum moved to New York City to begin his acting career.

No road to success was ever more winding than Baum's. He followed

With his life on the downward side of the rainbow, Baum moved his family west to the prairie.

the stage from job to job and state to state. Actors must moonlight, so Baum worked as a newspaper reporter, a dry goods salesman and finally as a playwright. His only hit, under the name Louis F. Baum, was an Irish melodrama called *The Maid of Arran*. Baum wrote and starred in the play that opened on his 26th birthday. The tall, mustachioed gentleman with the smiling eyes seemed on his way; so successful was he that he could even consider marriage.

According to the family legend, it was love at first sight. Maud Gage was a sophomore at Cornell University. On introducing him to Maud, his aunt said, "I'm sure you will love her." Baum smiled and replied, "Consider yourself loved, Miss Gage." Maud held out her hand and answered, "Thank you, Mr. Baum. That's a promise. Please see that you live up to it." He did. Married the next year, Frank and Maud Baum remained as devoted as any fairy tale couple. But Maud soon found that her husband often resided in a world entirely of his own.

Around the time of his marriage in 1882, Baum suffered a series of setbacks in business and health. To add to his burdens, his family's money had been lost. Maud's sisters and her brother had recently moved to the Dakota Territory, and their letters told of fortunes to be made. So in 1888, with his life on the downward side of the rainbow, Baum moved his family west to the prairie.

What is now Aberdeen, South Dakota, was then a boomtown of 3,000. Baum decided the town needed an upscale store and started Baum's Bazaar. The bazaar broke even for a while, but when the Dakota boom ended, the store went belly-up.

Broke and far from home, Baum fell back on old friends—his fantasies. The stories he told children on Aberdeen's dusty sidewalk spoke of a better land where goodness prevailed, love triumphed and no one was hungry or poor. Yet Baum was still required to make a living in this world, so he moved the family to Chicago in 1891.

For a time, he edited his own magazine promoting store window displays, but of more importance to children, he finally began to write down his stories. In 1897, his first successful book, *Mother Goose in Prose*, was published. His next book, *Father Goose, His Book*,

EVER WONDER
WHERE POETS
COME FROM?
-Georgie Sicking
Cowboy Poet
The vastness of her valleys
With streams untapped below,
The glory of her evenings
When the sun is sinking low.
Forged by heat of summer,
Blown true by winter's storm,
It is here, in my Nevada,
That a poet's heart is born.
Discover
Both Sides of
NEVADA
NEVADA
NV2000
Making Millennium Magic
Make some history with the ultimate millennium celebration - now through January 2001.
Call toll-free: 1-877-2000-NEV or visit us online at www.2000nevada.com.

ELEVETTE.
SO ELEGANT, PEOPLE FORGET IT'S PRACTICAL.

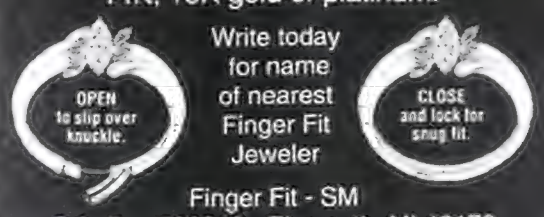
Practicality should never compromise the decor of your home. That's why **Elevette**™ offers both form and function. It's convenient yet elegant. Safe yet sophisticated. Reliable yet refined. So if you're thinking of adding an elevator, don't compromise. Get a custom-built Elevette to complement the unique style of your home. Tax-deductible when doctor recommended.

For more information call **1-800-456-1329**.

INCLINATOR COMPANY OF AMERICA
Dept. 4, PO Box 1557
Harrisburg, PA 17105-1557
E-mail us at **isales@inclinator.com**

Finger Fit
Makes Rings Fit!

Finger Fit opens 3 sizes to slip over enlarged knuckles. Safety clasp snaps closed for snug fit so rings won't twist. Jeweler-attached to most ladies' and men's rings. Choice of 10K, 14K, 18K gold or platinum.



Finger Fit - SM
P.O. Box 700840 • Plymouth, MI 48170
www.finger-fit.com

Celebrate July 4th & All Events
CARBIDE CANNON
BIG BANG! $139.95

Mammoth Cannons shoot with terrific BANG! Have a ball at special events. Also produced out [illegible]. Hundreds of uses for low cost. All metal construction with large, rugged cast iron wheels. Much fun to operate. Easy loading and firing. Authentic [illegible]-century design. Handsome decor when not in use. Made in USA to last a lifetime. Available in [illegible]. **$59.95 postpaid;** 17" cannon, **$109.95 postpaid;** 25" cannon (shown here) with rapid firing and automatic loading, **$139.95 postpaid.** The larger the cannon the louder the bang! **Carbide ammo, about 100 shots, $7.50; 3-pack $18.00. Spark plugs, 3-pack $2.00.** Send check, money order or call. Visa, MasterCard accepted by mail or phone. Give card number & expiration. Money-back guarantee. Send for **FREE CATALOG!**

The Conestoga Co., Inc., Dept S, PO Box 405, Bethlehem, PA 18016
★★ **Call 1-800-987-BANG** ★★
www.bigbangcannons.com

Baum entertains children on the lawn of the Hotel del Coronado, in Coronado, California, where he and his family spent winters from 1904 to 1910.

became the nation's best-selling children's title. After decades of dead ends, Baum had finally found his road.

Oz was born, as Baum recalled it, sometime in May 1898, when he was spinning a story he called "The Emerald City," featuring a tin woodman, a scarecrow and a cowardly lion. The tale drew neighborhood children to the Baum house just before bedtime to hear the latest installment. One evening a girl asked where the scarecrow and tin woodman lived. Stumped, Baum began scanning the room. Finally he noticed the filing cabinet in the corner. There he saw two drawers, one labeled A-N, the other O-Z. The Wonderful Wizard of An didn't seem very catchy, but Oz! The instant he saw it, he knew.

The Scarecrow, the Tin Woodman, the Cowardly Lion and a little girl named Dorothy. *The Wonderful Wizard of Oz.* It remains one of the best-selling children's books of all time, translated into 22 languages, including Tamil and Serbo-Croatian. Children may no longer seem as innocent as Dorothy Gale, but they still yearn, and Baum's story still soothes them. As the 1939 movie's epigram noted, "Time has been powerless to put its kindly philosophy out of fashion."

As Christmas approached in 1900, Baum trudged to his publisher's office to pick up his first advance on royalties for *The Wonderful Wizard of Oz.* Receiving the check, he put it in his pocket and headed home. When Maud asked how much it was, Baum said he did not know and handed it over. His wife had to hold herself up on her ironing board. The couple suddenly had $3,432.64 to spend on their sons. For the rest of Baum's life, first onstage, then in film, and finally in his dying words, he would never be far from Oz.

In Chicago, drama critics agreed that the hit of the 1902 season was a new musical called *The Wizard of Oz.* "When You Love, Love, Love" was

L. FRANK BAUM PAPERS, SPECIAL COLLECTIONS, SYRACUSE UNIVERSITY LIBRARY

the show's hit. All right, so it wasn't "Somewhere over the Rainbow," but *The Wizard of Oz* toured the country for nine years, even charming jaded New Yorkers during an 18-month run on Broadway.

Like Dorothy, Baum was at first not content to remain in Oz. He turned out instead what he called modern American fairy tales, ranging from the sugary *Dot and Tot of Merryland* to *The Master Key: A Electrical Fairy Tale*, which envisioned television and ray guns. Each day, however, his mail included dozens of letters from fans. Some asked him to write more about Oz. Finally, like the good father he was, Baum gave in to children's insatiable demands. In 1904, he wrote *The Marvelous Land of Oz*. In it, a boy named Tip journeys to the Emerald City where he finds the town taken over by a female army wielding knitting needles. Men are forced to do women's chores until Jack Pumpkinhead and a pedantic insect named H.M. (Highly Magnified) Woggle Bug, T.E. (Thoroughly Educated) restore Oz to its rightful ruler, Princess Ozma.

Assuming one sequel would satisfy readers, Baum set off for other dreamlands, often traveling incognito. In 1905 and 1906, using the nom de plume Schuyler Staunton, he wrote two adult novels. Capitalizing on the vogue of *The Bobbsey Twins* and other serials, he wrote dozens of children's adventures under various pen names. Readers bought the ruse, but many continued to clamor for Oz, which Baum was finding a tough act to follow. Critics heaped scorn on his play *The Woggle Bug*, calling it a pale imitation of *The Wizard of Oz*. Other stage projects failed; still Baum dreamed on. With vaudeville in vogue, he toured the Midwest with his "Fairylogue and Radio Plays." Dressed in a white frock coat and red carnation, he narrated while Oz characters stepped out of slides and film clips hand colored by Michael Radio and projected onscreen. The presentation was backed by an onstage

www.edgeco.com

Replicas of the Past, Electronics of the Future

Just $39.95

THE NEW 2000 SILVER DOLLAR
#C-2001-1

A genuine uncirculated mint masterpiece, and the largest silver coin in history. Pure .999 fine silver.

Each with a Certificate of Authenticity and a velvet jewel box.

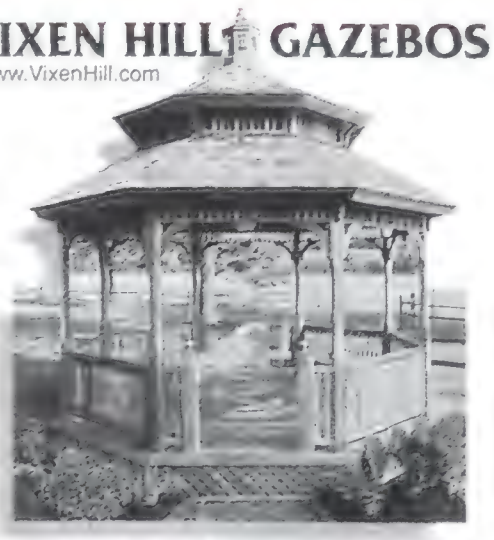
Crafted by the American Historic Society, the beautiful figure of Walking Liberty is intensely colored in brilliant reds, blues, whites, and golds.

THE EDGE COMPANY CATALOG
17 KIT STREET, KEENE, NH 03431

KEY #SM0600
CALL TO REQUEST A FREE CATALOG

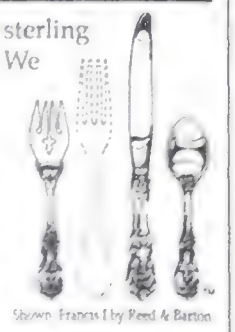
1-800-732-9976
CALL TODAY AND ORDER

VIXEN HILL GAZEBOS
www.VixenHill.com



MISSING A PIECE OF YOUR PATTERN?

Replace pieces or add to your sterling silver at up to 75% off retail. We specialize in new and used flatware and hollowware. Over 1,200 patterns in stock. Call or write for a free inventory of your sterling pattern. *(We buy sterling silver, with a careful appraisal for maximum value.)*



Shown: Francis I by Reed & Barton

Beverly Bremer
SILVER SHOP
3164 Peachtree Rd. NE, Dept SM, Atlanta, GA 30305 / Mon.-Sat. 10-5
Tel: 404-261-4009, Fax: 404-261-9708 www.beverlybremer.com

POLAR BEARS

Join us for the world's greatest gathering of polar bears in Churchill, Manitoba along the shore of Hudson Bay.

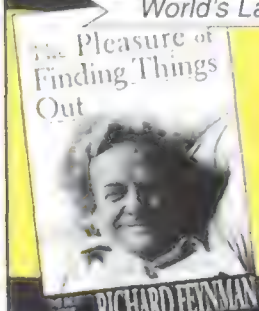
800-368-0077
www.travelwild.com

Wild Expeditions SM51

SWEET HEART

James Breakell's pretty pendant with 18" chain. Sterling silver $30. 14k Gold $195. Add $4 handling. Catalog available (800)767-6411. www.breakell.com

J.H. Breakell & Co.
132 Spring St., Dept. SMSH, Newport, RI 02840

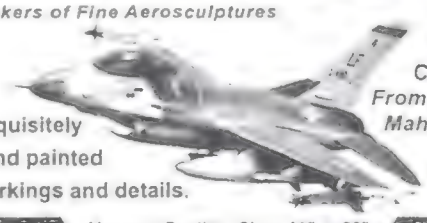
BOOKS ON TAPE® #1
World's Largest Selection


• Bestsellers on cassette
• Nearly 5,000 titles all full-length
• Call for more information
(800) 582-9666

Great Walks in Europe

England, Scotland, Ireland, France, Spain and Italy. Experienced and knowledgeable guides. All ages and abilities are welcome.
CROSS COUNTRY INTERNATIONAL
(800)828-8768 e-mail XCINTL@aol.com

WARPLANES.COM

Makers of Fine Aerosculptures

Hand Carved From Solid Mahogany
Exquisitely hand painted markings and details.
Satisfaction Guaranteed!
Museum Quality • Sizes 16" to 22" Stand Included • From $99.95
Catalog & Orders
800-950-9944
www.warplanes.com
Over 750 Models In Stock
14255 N. 79th St. • Scottsdale, AZ 85260

COUNTRY WALKERS
Join us for our 21st year offering worldwide walking vacations
◆Small groups
◆Knowledgeable local guides
◆Fine accommodations & cuisine
44 unique itineraries throughout Europe, North and South America, Africa and the South Pacific.
Free catalog 800-638-0291
www.countrywalkers.com

AFRICA ◆ CHINA ◆ INDIA ◆ JAPAN ◆ NEPAL ◆ SRI LANKA ◆ TAIWAN
Since 1989
UPTON TEA IMPORTS
Purveyor of the World's Finest Teas
1-800-234-8327
www.uptontea.com
Free catalog listing over 220 varieties of garden-fresh, loose tea
231 South St. * Hopkinton, MA 01748

orchestra. The play was well received but it drained Baum financially. In 1911, Baum declared bankruptcy, and the royalties from his Oz books were put in the hands of a trustee. Three years later, he formed the Oz Film Manufacturing Company. None of the company's five films did well at the box office, however, and its studios closed.

Unable to sell Oz on stage or screen, Baum reluctantly returned to prose. After writing *Ozma of Oz* in 1907, he did another sequel two years later. Lacking the stronger theme of the original, the later Oz books were pure fun and fantasy. They feature oddities such as lunch-box trees, a bestiary of wacky creatures—the Yips, the Tottenhots, the Fuddles—and evil villains like the Nome King.

Dorothy returns to Oz over and over, once even bringing her Aunt Em and Uncle Henry. But Baum grew tired of the series. At the conclusion of *The Emerald City of Oz*, he informs his readers that he has received a letter from Princess Dorothy. To escape invasion by the Nome King, Glinda the Good has made Oz invisible. "You will never hear anything more about Oz, because we are now cut off forever from all the rest of the world," Dorothy writes. In the meantime, Baum had an earthly utopia to tend.

In 1910, the Baums moved to a small Southern California town beneath a clear, blue sky. It was called Hollywood. There, using Maud's inheritance, Baum built Ozcot. The interior of the two-story home was dominated by bookshelves filled to the ceiling, ornate trim and emerald-green lampshades designed by Baum himself. Outside was an enormous garden where he grew award-winning dahlias and chrysanthemums. But for Baum, no paradise would be complete without children. Now that his were grown, he welcomed school groups visiting the "Royal Historian of Oz." Surrounded by fellow playmates, he took a child or two in his lap and told stories by the hour. The visits, the gar-

Chadwick Pictures produced a silent movie version of *The Wizard of Oz* in 1925, but it failed at the box office and soon disappeared from memory.

A 1978 movie, *The Wiz*, starred Diana Ross (above) and Michael Jackson.

den and his daily dose of writing were welcome relief from a world that was becoming more painful with each passing year. Along with angina attacks that had him walking the floor in tears, he suffered from a facial palsy and from a diseased gallbladder. Besieged from within, he turned more often to the land of Oz.

In 1913, he "discovered" a radio that restored communication with Dorothy. Thereafter he wrote one Oz book a year, often relying on readers' suggestions for his next plot. He finished the final two in bed where a gallbladder operation confined him for his last 18 months.

In May 1919, after making notes for his 15th Oz book, his heart began to beat erratically and he slipped into a coma. He regained consciousness twice, once to tell his wife "there has never been another woman in my life," and once to foresee his final journey. With Maud at his bedside, he said quite clearly, "Now we can cross the Shifting Sands." The next day, the *New York Times* obituary noted, "L. Frank Baum is dead, and the children, if they knew it, would mourn."

Oz lived on after Baum, chiefly in the books written by seven other authors. Oh, and there were movies—a 1925 film starring Oliver Hardy as the Tin Woodman, and then a 1939 version you might have seen somewhere. A century after Baum first created Oz, that magical land is indelibly imprinted on American culture. It's hard to get through a week without encountering some reference—an ad, a cartoon or just someone joking "Toto, I have a feeling we're not in Kansas anymore." And as baby boomers nostalgically recall the film from its annual TV showings, Ozmania has soared like a Kansas farmhouse caught in a cyclone. It has swept all the way to the Library of Congress, where an exhibition marking the 100th anniversary of the story will run until September 23.

When Jean Nelson first opened Yellow Brick Road in 1978, there was barely enough Oz stuff to stock her gift store in Chesterton, Indiana. But Nelson has since turned Chesterton into a Mecca for Oz fans. For 18 years, the small town an hour east of Chicago has hosted an Oz festival, one of several held annually around the country. Before they died, scarecrow Ray Bolger used to call the shop from time to time and wicked witch Margaret Hamilton once spent three days working with Nelson there. Last September, former Munchkins signed autographs while collectors swapped items that made Oz seem more like a farmers' market than a fantasy. You name the object—hats, T-shirts, computer mouse pads, mugs, dolls, aprons, refrigerator magnets—and you can find an Oz version. Amid such commercialism, can Baum's innocence survive? Nelson isn't worried. All Oz books still sell well, she assured me, including those written today by Frank's great-grandson, Roger Baum.

Along with the perils of commercialization, Oz has been invaded by a scourge of academics. Baum's fantasy, some say, has become "America's secular myth," and like all myths, it's wide open to interpretation. Psychoanalysts have charted the characters'

CIRCLE South America

Seven Seas Navigator

GRAND 58-NIGHT CRUISE
FEBRUARY 2 - APRIL 1, 2001
FT. LAUDERDALE TO FT. LAUDERDALE
Fares start at $17,010 per person including Free First Class Airfare*

4 SEGMENT CRUISE OPTIONS**

FEB. 2 — 12 NIGHTS
FT. LAUDERDALE TO CALLAO (LIMA)

FEB. 14 — 18 NIGHTS
CALLAO (LIMA) TO BUENOS AIRES

MAR. 4 — 16 NIGHTS
BUENOS AIRES TO MANAUS

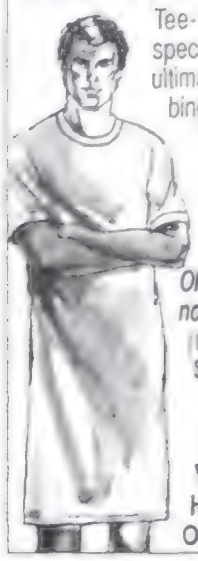
MAR. 20 — 12 NIGHTS
MANAUS TO FT. LAUDERDALE

***Segment fares from $3,971 per person. Itineraries are combinable with additional savings.*Prices quoted include all savings. Port charges additional.*

CONTACT YOUR TRAVEL AGENT OR CALL 1.800.285.1835 FOR A BROCHURE, OR VISIT OUR WEBSITE: WWW.RSSC.COM

RADISSON SEVEN SEAS CRUISES

Better Way To Sleep
Soft 100% Cotton Knit TeePJs™



Tee-PJs are not ordinary nightshirts. The special knit moves as you move for the ultimate in sleeping and lounging comfort. No bind, no bunch, no buttons, no side seams.
Most comfortable sleeper you've ever worn or your money back!
Great for Ladies, too.
White or Soft Blue. SIZES to fit **90-300 lbs.**
Specify man/lady and **height/weight**.
ORDER NOW, while prices include S&H and no extra charge for XXL & XXXL on 1st order!
(Can't wait? For RUSH AIR delivery add $2)
$21.95 ea. 2 for $38.85 (Save $5)
Long sleeve style (not shown)
$26.95 ea. 2 for $46.90 (Save $7)
WITTMANN TEXTILES, Dept. 482,
Hobe Sound, FL 33475 *(ship to FLA add tax)*
ORDER BY MAIL (OR 1-561-546-4656)

RETHINK TIME

Time by Design digital watch
TO ORDER: 1-800-721-2611
www.timebydesign.com
$120.00

KOBAL COLLECTION

As close to the real thing as there is!

Brighten your home and enrich your spirit with beautiful artworks. It is possible with our painstakingly handcrafted and pleasingly affordable replicas.

NEW Free Color Catalogue
1-800-942-2044, Dept. 1303
www.MastersCollection.com
THE MASTERS' COLLECTION

World's Largest Inventory!
China, Crystal, Silver & Collectibles
• *Old & New*
• *125,000 Patterns*
• *6 Million Pieces*
• *Buy & Sell*
Call for **FREE** lists.

REPLACEMENTS, LTD.
PO Box 26029, Greensboro, NC 27420 Dept. SM
1-800-REPLACE (1-800-737-5223)
www.replacements.com

MEN'S WIDE SHOES
EEE-EEEEEE, SIZES 5-13
FREE catalog • High quality • 160 styles

HITCHCOCK SHOES, INC.
Dept. 21F Hingham, MA 02043
1-800-992-WIDE www.wideshoes.com

AUTHORS WANTED
800.278.8533
rutledgebooks.com
RUTLEDGE BOOKS, INC.
Dept. SM, P.O. Box 315
Bethel, CT 06801

Successful, full service subsidy publisher can transform your manuscript into a quality book... and promote it. Send completed work for a **FREE** assessment. **FREE** brochure.

COPPER CANYON
CUSTOM DESIGNED ADVENTURES
Naturalist-trained native guides • Remote wilderness lodges
Birding • Natural History • Cultural Contacts • Photography
Sierra Madre train • Tarahumara & Mayo Indians
1-800-843-1060 www.canyontravel.com
Columbus Travel, 900 Ridge Creek, Bulverde, TX 78163

L. FRANK BAUM · OZ MUSEUM, NEW YORK

Frank Baum sat for a portrait in 1881 during his stage days in New York.

low self-esteem. One Marxist read the story as a response to the alienation caused by capitalism. The most famous interpretation, originally concocted as a teaching aid by educator Henry M. Littlefield, said Oz is Baum's treatise on populism, with Dorothy's shoes—in the book silver, not ruby red—promoting the 1890s cause of free silver championed by William Jennings Bryan, a.k.a. the Cowardly Lion. Others have objected to the tale on religious grounds, and the book has even been removed from library shelves. These critics all have both courage and brains. If they only had a heart, they might see Baum's sole reason for creating his wonderful land.

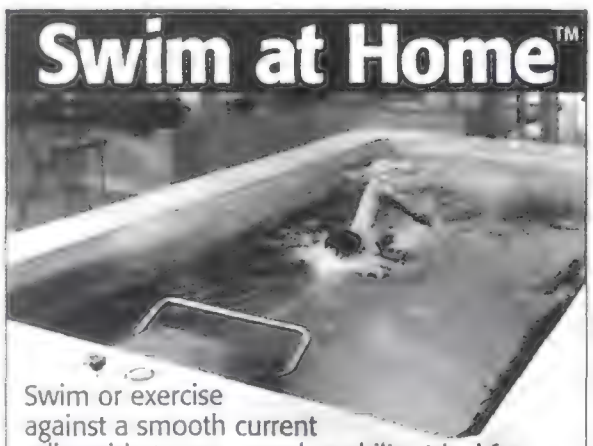
"When I was young I longed to write a great novel that should win me fame," Baum wrote to his sister in 1897. "Now that I am getting old my first book is written to amuse children. For, aside from my evident inability to do anything 'great,' I have learned to regard fame as a will-o-the-wisp which, when caught, is not worth the possession; but to please a child is a sweet and lovely thing that warms one's heart and brings it's own reward."

Bruce Watson wrote last month on the history of pi. An anthology of his humorous essays, Info-Aged, *was published in 1999.*

Don't Wait Until It's Too Late!

START FIGHTING SKIN CANCER NOW!
Recommended By Dermatologists For 13 Years
Andrew's Sun Hat offers many advantages:
• Wider brim **All** around, 2½" min. vs 1" on most bucket hats.
• **No Exposure At The Temple**, plenty of shade for side of face and back of neck.
• 4" visor-like reinforced front brim with green underside to **Fight Glare**.
• Poly/cotton fabric is **Cool** and absorbent.
• **Lightweight.** Stitched eyelets for **Ventilation**.
• **Great Looking.** Traditional look with enough flare to provide **Excellent Protection**.
What's my hat size? Measure around your head 1" above your eyebrows and give us that measurement when ordering.
Color: Light Khaki, Chalk White or Navy.
Sizes: S (6 3/4-6 7/8); M (7-7-1/8); L (7 1/4-7 3/8); XL (7 1/2-7 5/8); XXL (7 3/4-8)
Price: $24.00 + $5.75 shipping per order.
• *Ask about our mesh sided style,* ***The Airflow.*** •
For color photos and more information about our sun hats and other products visit our web site at:
www.andrewthompsoncompany.com
Call (423) 886-5189 with MC or Visa
Or Send Check or Money Order to:
Andrew Thompson Co.
843 Arden Way, Dept. S-1
Signal Mtn, TN 37377
FINE GOODS Andrew Thompson Co. of Chattanooga
Your Satisfaction Guaranteed Or Your Money Back.

Swim at Home™



Swim or exercise against a smooth current adjustable to any speed or ability. Ideal for swimming, water aerobics, rehabilitation and fun. The 8' x 15' Endless Pool® is simple to maintain, economical to run, and easy to install inside or outdoors.
FOR FREE VIDEO CALL
(800) 233-0741, Ext. 1134
or visit www.endlesspools.com
200 E Dutton Mill Rd, Dept 1134
Aston, PA 19014
ENDLESS POOLS

www.yesteryeartoys.com
STEAM MODELS
Stirling Hot Air Engines
NEW!
Stirling Hot Air Engine w/ Swiss Music Box
D405 Steam Tractor
STUNNING 43 PG. COLOR CATALOG $6.95
Refundable with Order.
Over 150 Working Steam Engines in Kits or Assembled. We Also Carry 100 Different Limited Edition Tin Toys Mechanical, Steam Powered or Musical as well as Stirling Hot Air Engines.
Parts & Accessories Available.
YESTERYEAR TOYS & BOOKS INC.
Dept. SM2 • Box 537 • Alexandria Bay • NY 13607
☎ 1-800-481-1353 FAX: 1-800-305-5138

PERSONALIZED CARTOUCHE JEWELRY
HANDMADE IN EGYPT
Translate Anything into Ancient Egyptian Hieroglyphics
18k Gold and Silver Pendants, Rings and Bracelets
Call us for a free brochure and more information
Discoveries Egyptian Imports
2910 Business Center Dr. dept. SM · Alexandria, Va. 22314
or visit our website at:
http://www.egyptianimports.com
"Love"
DISCOVERIES EGYPTIAN IMPORTS
1-800-237-3358
Celebrating our 20th Year Anniversary!

www.seeitaly.com
CARAVELLA ITALIA
EXPERIENCE THE BEST OF ITALY
SMALL GROUP TOURS • CUSTOM TOURS
toll-free 888.665.2112

HARP SEALS
Visit the harp seal pups on the pack ice of the Gulf of St. Lawrence.
800-368-0077
www.travelwild.com
TravelWild Expeditions SM53

Russia & Ukraine
Baltics • Moldova • Belarus • Poland
Small group journeys & independent travel
www.mircorp.com
Free brochure 800 424 7289
MIR

www.e-knits.com
e-knits.com
Knitting on the Net

Memorial Tear ®
This is a tear drop to be worn in memory of someone loved. The rose inside the tear is a symbol of the love that never dies
+ CHRISTIAN FAMILY JEWELERS
800-466-8092
Please add $3.95 for shipping and handling
Pendant / Lapel Pin
Sterling $28.95
14K Gold $89.95
www.christianfamilyjlrs.com

Points of Interest [p. 16]

Music From the Heart by Rod Kennedy, Eakin Press (Austin, Texas), 1998

Kerrville Folk Festival Website: www.kerrville-music.com

The Object at Hand [p. 22]

A Machine Called Indomitable by Sonny Kleinfield, Times Books (New York), 1985

The Pioneers of NMR and Magnetic Resonance in Medicine: The Story of MRI by James Mattson and Merrill Simon, Dean Books (Jericho, New York), 1996

Principles of Magnetic Resonance Imaging: A Signal Processing Perspective by Zhi-Pei Liang and Paul C. Lauterbur, IEEE Press (New York), 2000

MIT "Touch Lab" [p. 38]

The Hand by Frank R. Wilson, Pantheon Books, 1998

MIT Touch Lab Website: http://touchlab.mit.edu/

Hands by John Napier, Pantheon, 1980

British Canals [p. 50]

British Waterways, Willow Grange, Church Road, Watford WD1 3QA, United Kingdom; Website: www.britishwaterways.co.uk

English Heritage Book of Canals by Nigel Crowe, B.T. Batsford Ltd. (London), 1994

British Canals: An Illustrated History by Charles Hadfield, David & Charles (London), 1984

Experience Music Project [p. 68]

Experience Music Project Website: www.emplive.com

Wild and Wooly: The Northwest Rock Collection (compact disk), Experience Music Project (Seattle), forthcoming

Crosstown Traffic: Jimi Hendrix and the Post-War Rock'n'Roll Revolution by

Eight Northern Indian Pueblos
29th Annual
Artist and Craftsman Show
San Juan Pueblo • July 15 & 16, 2000
(Just North of Santa Fe, New Mexico)
Call: 800-793-4955

DRINK TEA?
THE FINEST TEAS AND GIFTS
WWW.TEALUXE.COM
1-888-TEALUXE

Maine. Fresh Breezes & Star-filled Nights. Fill your Sails with a Tall Ship Sailing Adventure.
www.sailmainecoast.com
1-800-807-WIND

22nd year tours of
BORA ÖZKÖK & CULTURAL FOLK TOURS
TURKEY
Quality tours for less
Call 1-800-935-8875
http://www.boraozkok.com • E-mail:tourinfo@boraozkok.com
CA Tour Operator Reg. #2011417-40

AUTHORS WANTED
Leading subsidy book publisher seeks manuscripts. Fiction, non-fiction, poetry, juvenile, religious, etc. New authors welcomed. For free 32-page illustrated guidebook TD-72, call 1-800-821-3990 or write to:
Vantage Press, 516 W 34th St., New York, NY 10001

LONDON FLATS
Short Term - Privately owned
PARIS PROPERTIES - COTSWOLD COTTAGES
THE LONDON CONNECTION
TOLL FREE PHONE: 888-393-9120
FAX: 801-393-3024
E:MAIL sales@londonconnection.com
www.londonconnection.com

COPPER CANYON
Costa Rica and More
Explore Mexico's Copper Canyon and Costa Rica on our deluxe escorted and custom adventures. For free newsletter:
1-800-926-1140
www.calnative.com
The California Native, 6701 W. 87 Pl, Los Angeles, CA 90045

If you are moving soon, please send an address label from a recent issue along with your new address to:
Smithsonian Membership
Data-Center
P.O. Box 420312
Palm Coast, FL 32142-0312
or call
1-800-766-2149

GALAPAGOS
Learn about the Origins of Species from our gifted naturalist as you explore Darwin's islands in comfort aboard small, deluxe yachts. Swim with penguins and sea lions, savor equatorial sunsets, and really get away! Free brochure and video
INCA
1311 SG1 63rd St.
Emeryville, CA 94608
(510) 420-1550
Sg1@incafloats.com
www.incafloats.com

EUROPE $325 ROUNDTRIP
Madrid, Amsterdam, Rome $325. Hawaii $238. Australia $950. Bangkok, Seoul, Manila, Singapore $400. ALL ROUNDTRIP!
1-800-822-0888 x2206
Cheaptrips.com
(303-215-9000) www.cheaptrips.com
Subject to availability, membership, & departure

Lobster Clambakes $59.95 (Plus shipping)
2 - 1 1/2 Maine Lobsters Live
2 lb Steamers Clams
1 Qt clam chowder
Claw crackers, bibs, wetnaps, forks
Simple cooking instructions
FREE SEAFOOD CATALOG
1-888-732-3663
100% Guaranteed
www.freshfish.net Fishermans Fleet Inc.

EXPLORE ANTARCTICA...
A land like no other in the geography and history of the world...aboard the 122-passenger *Clipper Adventurer* during the austral spring and summer, 2000/2001
1-800-282-7245 www.clippercruise.com
CLIPPER

www.vancort.com
Telescopes ✧ Kaleidoscopes ✧ Compasses
Orreries ✧ Magnifiers
Timepieces & Weather Instruments
Van Cort Instruments, Inc.
South Deerfield, MA
800-432-2678 413-665-2000

WHAT'S IT LIKE OUT THERE?
Barometric pressure? Indoor/outdoor temperatures? Wind speed/direction? Rainfall? What's the exact time?
Incredible OREGON SCIENTIFIC Weather Stations and Atomic Clocks: $59 and up!
givemeair.com
more info: 1-800-443-4554

SMITHSONIAN (ISSN 0037-7333) is published monthly by the Smithsonian Associates, 900 Jefferson Drive, Washington, DC 20560. © Smithsonian Institution 2000. All rights reserved Reproduction in whole or in part without permission is prohibited. Editorial offices are at 900 Jefferson Drive, SW, Washington, DC 20560 (202-786-2900). Advertising and circulation offices are at 420 Lexington Ave., New York, NY 10170 (212-490-2510). **Subscription Prices:** United States and possessions: $26 a year payable in U.S. funds. Canada and all other countries: add $13 (U.S. funds) for each year. 80 percent of dues is designated for magazine subscriptions. Current issue price is $4 (U.S. funds). Back issue price is $5 (U.S. funds). Periodical postage paid at Washington, DC and additional mailing offices. **Mailing Lists:** From time to time we make our subscriber list available to companies that sell goods and services by mail that we believe would interest our readers. If you would rather not receive such mailings, please send your current mailing label, or an exact copy, to: SMITHSONIAN, Mail Preference Service, P.O. Box 420311, Palm Coast, FL 32142-0311. **Subscription Service:** Should you wish to change your address, or order new subscriptions, you can do so by writing SMITHSONIAN, P.O. Box 420311, Palm Coast, FL 32142-0311, or by calling 1-800-766-2149 [outside of U.S., call 1-904-445-4662] Postmaster: Send address changes to SMITHSONIAN, P.O. Box 420312, Palm Coast, FL 32142-0312. Printed in the USA.

Charles Shaar Murray, St. Martin's Press (New York), 1991

Rock and Roll: An Unruly History by Robert Palmer, Harmony Books (New York), 1995

Chardin [p. 80]

Chardin (exhibition catalogue), Royal Academy of Arts (London)/The Metropolitan Museum of Art (New York), 2000

Chardin: 1699-1779 by Pierre Rosenberg, Cleveland Museum of Art, 1979

Chardin by Philip Conisbee, Bucknell University Press, 1986

Bighorn Sheep [p. 90]

Return to Royalty: Wild Sheep of North America by Dale E. Toweill and Valerius Geist, Boone and Crockett Club and Foundation for North American Wild Sheep (Missoula, Montana), 1999

Bighorn Institute, P.O. Box 262, Palm Desert, California 92261-0262; Telephone: (760)346-7334; Website: http://www.bighorninstitute.org/

Foundation for North American Wild Sheep, 720 Allen Avenue, Cody, Wyoming 82414; Telephone: (307) 527-6261; Website: http://www.fnaws.org/page1.html

Sierra Nevada Bighorn Sheep Foundation, P.O. Box 1183, Bishop, California 93514; Website: http://www.sierrabighorn.org/

Mustard [p. 102]

A Dash of Mustard: Mustard in the Kitchen and on the Table by Katy Holder and Jane Newdick, Chartwell Books (Edison, New Jersey), 1995

L. Frank Baum [p. 112]

To Please A Child: A Biography of L. Frank Baum, Royal Historian of Oz by Frank Joslyn Baum and Russell P. MacFall, Reilly & Lee Company (Chicago), 1963

The Wizard Of Oz & Who He Was by Martin Gardner and Russel B. Nye, Michigan State University Press (East Lansing), 1957

L. Frank Baum: Royal Historian of Oz by Angelica Shirley Carpenter and Jean Shirley (for children), Learner Publications (Minneapolis), 1992

Put the weather on your wall
The Weather Picture™ is an eye-popping new wall unit that continuously displays all the vital weather data you've pre-selected. Big red numerals are easy to read from across the room, day or night. Available in 2 sizes, in an elegant brushed aluminum or solid oak or teak frame. Teamed with our famous ***ULTIMETER®*** Weather Station, The Weather Picture System provides plenty of data to satisfy the most dedicated weather buff. For complete details, call or write us. Or visit us online to *see and actually try* our ***ULTIMETER*** Systems.
www.peetbros.com
PEET BROS. COMPANY
Dept. SM, 31 E. 17th Street,
St. Cloud FL 34769
Toll free: 800-USA-PEET

Our Exclusive Design
Sterling Silver Pansy Necklace with Pearl ~ $65
Available in 18Kt Gold ~ $525
La Perla LTD
FINE JEWELERS
(800)209-0989
www.laperlajewelers.com

THE POKE BOAT®
IT'S EVERYTHING A CANOE ISN'T.
A canoe is tippy. A Poke Boat isn't. It's remarkably stable.
A canoe is hard to turn and difficult to keep in a straight line. A Poke Boat isn't. It stays in a straight line, yet is easy to maneuver.
A canoe is heavy. A Poke Boat isn't.
It weighs only 22 pounds - built with aircraft strength.
You can buy more than a canoe.
For more information, give us a call.
859-986-2336

Cartouche
18K Solid Gold or Sterling Silver.
A Talisman with *Your Name* in Hieroglyphics.
Protective Charms, Powerful Amulets, Beautiful Gifts.
P.O. Box 309-SM, Delmont, PA 15626 E-mail: sm@cartouchedtd.com
For a Free Catalog Call 1-800-283-4978

Rent a villa in Italy
DISCOVER PARADISE FOR A WEEK OR LONGER
ALL SIZES, PRICES AND LOCATIONS THROUGHOUT ITALY
800 280 2811
THE PARKER COMPANY www.theparkercompany.com
ITALIA

Smithsonian Study Tours

To request a Study Tours catalog call: 1-877-EDU-TOUR Toll-free
(1-877-338-8687)
(202) 357-4700 In the Washington, DC area
www.si.edu/tsa/sst

American Snapshots

Specially arranged weekends in towns and communities that celebrate the nation's vast diversity.

Lexington, Kentucky, October 19-22

Galveston, Texas, March 15-18, 2001

Christmas Tours

Christmas in Prague, December 18-27

Kenya Family Christmas Safari
December 19-31

Christmas in Savannah and Charleston
December 20-26

Christmas in London, December 20-27

Christmas in Bath, December 20-27

Christmas in Santa Fe, December 21-26

Christmas in Quebec City, December 22-27

Cruises

Legendary Landscapes of the Yangtze River
September 14-October 1 aboard the *East Queen*

NEW!
Islands and Wildlife of the Pacific Northwest
September 18-24 aboard the *M.V. Sea Bird*

Turkey's Turquoise Coast, September 21-October 2 aboard small Turkish gulets

Voyage to Antiquity (Turkey), September 22-October 8 aboard the *Sea Cloud*

Undiscovered Greek Isles
September 27-October 8 aboard the *Clelia II*

Hidden Treasures of Italy's Po River
September 29-October 10 aboard the *Venezia*

Australia's Great Barrier Reef, October 4-13 aboard the *Coral Princess II*

Lost Islands of the South Atlantic, October 4-November 3 aboard the *Explorer*

Sail into Antiquity, October 18-28 aboard the *Sea Cloud*

America's Tidewater Heritage, October 24-November 4 aboard the *Nantucket Clipper*

Atlantic Crossing: Lisbon to Barbados
November 10-20 aboard the *Crystal Harmony*

U.S and Canada Land Tours

Smithsonian at Chautauqua: American Speeches, August 19-26

Rocky Mountain Hiking, August 26-September 2

Grand Canyon Sampler, September 1-4 and September 8-11

Utah's Red Rock Country, September 6-14

NEW!
Vermont: Hiking in the Green Mountains
September 11-17

NEW!
Boston: Art and Private Collections
September 21-24

NEW!
Breaking the Confederate River Barrier
September 25-30

Chicago: Treasures of Art and Architecture
October 4-8

Lincoln's Washington, October 19-23

National Parks of the West, October 28-November 3 aboard the *American Orient Express*

The Golden Age of Flight (Washington, DC)
November 2-5

Wyeth Country: The Brandywine Valley
November 2-5

Yosemite to Big Sur, November 4-10

Florida Manatees, November 4-8

Art Nouveau: The Exuberant Art (Washington, DC), November 10-14

Art and Spirit of Georgia O'Keeffe (Santa Fe)
November 15-19

International Land Tours

Journeys to special corners of Europe, Asia, Africa, Central and South America.

Provence: Walks in the Autumn Sun
October 2-11

Cornwall Countryside, October 9-19

Mystery Lover's England, October 11-18

Copper Canyon: Mexico's Sierra Madres
October 15-23, January 27-February 4

Northern Italy Countryside, October 18-29

Joys of the Italian Table, October 22-November 1

Japan Journey, October 26-November 6

Himalayan Kingdoms, October 30-November 17

Rome: Western Civilization and the Eternal City, November 3-14

Mysteries of Easter Island, November 5-13

China Insights, November 5-16

Temples of Thailand and Angkor
November 8-23

Venice Interlude, November 10-18

Odyssey Tours

Moderately priced tours with multiple departure dates.

Images of Ireland, August 22-September 3 and September 5-17

NEW!
Sojourn Adventure in Borneo, September 8-21 and October 6-19

Ancient Capitals of Beijing and Xi'an
September 16-26 and November 4-14

Egypt's Ancient Lands with a Nile Cruise
September 20-October 2 and October 11-23

Sojourn in Greece: An All-Inclusive Resort Stay in Vravrona, October 3-16, October 17-30

For a Smithsonian Odyssey Tour brochure, call 1-800-932-8287.

To request a catalog call 1-877-EDU-TOUR or visit www.si.edu/tsa/sst

THE LAST PAGE

Shop for This Label: "No Assembly Required"

BY DANNY HEITMAN

RECENTLY MY WIFE AND I PURCHASED A NEW OUTdoor gas grill. It was delivered to our house in a big cardboard box. The label on the outside of the box said an average person ought to be able to put the thing together in three hours. I am not now and never have been an average person. When it comes to fixing things, I always figure if it has to be done right, it had better be done by someone else. So I kept the box in the living room and contemplated it for days.

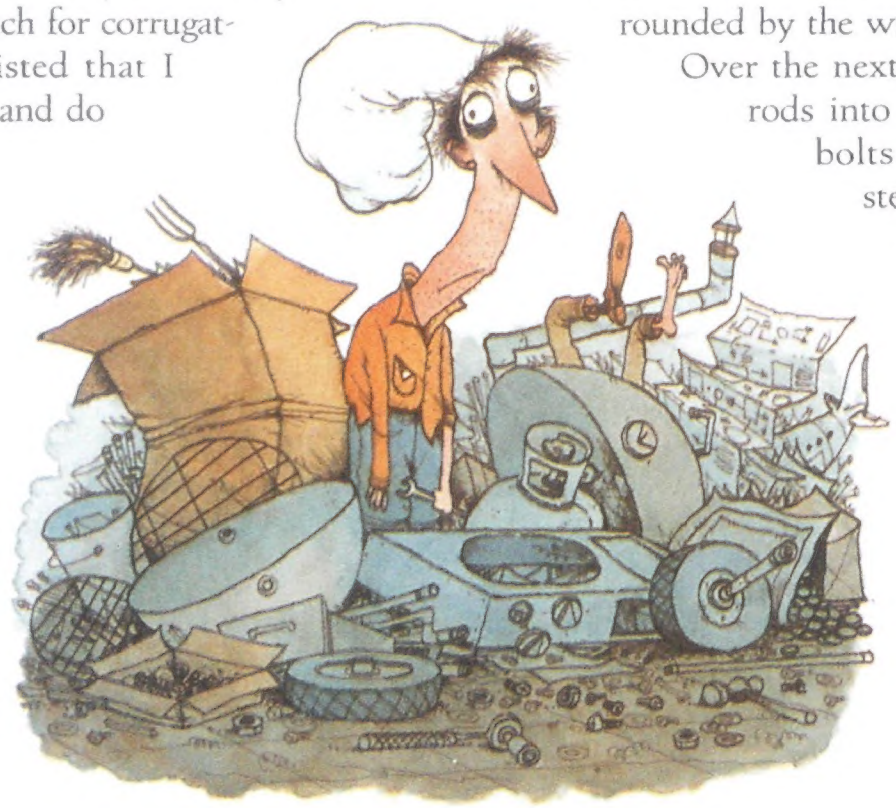
In our house, any unoccupied surface soon becomes a reef of domestic sediment. If the ironing board stays up for an hour, somebody will start using it as a kitchen counter. In no time at all, our boxed grill had been converted into a coffee table. I found it a convenient perch for beverages, books and what have you. But my wife, who has never cared much for corrugated furniture, eventually insisted that I empty the box of its contents and do what had to be done.

Reluctantly, I opened the top and removed the directions, which featured an exploded diagram of some 100 parts. Exploded diagrams give me the creeps. The pieces, drawn as if they are flying apart, resemble a blueprint for some kind of terrorist bomb. These particular directions also reminded me that my grill would run on propane. I imagined myself in a burst of blue flame, my head (Part A) at some distance from my limbs (Parts B through E).

The language employed in the directions might best be described as English in the larval stage. Certain arrangements of words suggested the mother tongue, but for the most part the syntax was impenetrable. Finally, one day I decided to ask a couple of friends over to give me a hand. They picked up the directions, squinted and sighed.

We tried reading passages aloud, hoping for divine guidance. When it was not forthcoming, things took a political turn for the worse. One friend, a conservative, insisted on a literal interpretation of the text, cautioning against flights of fancy. His liberal opponent was all in favor of improvisation, and let the fine print be damned. I tried to broker a compromise. When my wife peeked in around midnight, each of us was ranting in a different corner of the room. A scattering of metal lay at our feet. We looked like dazed survivors of an airplane crash surrounded by the wreckage.

Over the next several evenings, we forced rods into sockets, threaded nuts onto bolts and clipped aluminum to steel. A gas grill began to take shape before our disbelieving eyes. Now complete, it actually works. During pleasant evenings outside, my wife and I slap a steak on the range top (Part D-1), slather it with sauce (See Section IV-A on Meal Preparation), then watch it sizzle (Ideal Cooking Temperatures, Section IV-B). The whole experience has taught me a valuable lesson. The three most important words in a marriage may be "I love you," but there's definitely something to be said for "No assembly required."



A scattering of metal lay at our feet. We looked like dazed survivors of an airplane crash surrounded by the wreckage.

DAVID CLARK

are you digital yet?™

PowerShot

S10

2.1 Megapixels

It's so much digital know how, we needed two models just to hold it. Canon PowerShot Digital. Visit our website to get the full picture on both.

S20

3.3 Megapixels

Digital just got twice as amazing. The 2.1 megapixel PowerShot S10 and the all-new 3.3 megapixel PowerShot S20. Each with sleek compact designs, superb high resolution and advanced optics.

www.powershot.com

© 2000 Canon U.S.A., Inc. "are you digital yet?", PowerShot and Canon Know How are trademarks of Canon Inc.

Canon KNOW HOW™

ABSOLUT®
Country of Sweden
VODKA
This superb vodka
was distilled from grain grown
in the rich fields of Southern Sweden.
It has been produced at the famous
old distilleries near Åhus
in accordance with more than
400 years of Swedish tradition.
Vodka has been sold under the name
Absolut since 1879.
40% ALC./VOL. (80 PROOF) 1 LITER
IMPORTED
PRODUCED AND BOTTLED IN ÅHUS, SWEDEN
BY THE ABSOLUT COMPANY
A DIVISION OF V&S VIN&SPRIT AB

ABSOLUT HOMAGE.

ABSOLUT VODKA. PRODUCT OF SWEDEN. 40 AND 50% ALC/VOL (80 AND 100 PROOF). 100% GRAIN NEUTRAL SPIRITS. ABSOLUT COUNTRY OF SWEDEN VODKA & LOGO, ABSOLUT, ABSOLUT BOTTLE DESIGN, ABSOLUT CALLIGRAPHY AND ABSOLUTVODKA.COM ARE TRADEMARKS OWNED BY V&S VIN & SPRIT AB. ©1999 V&S VIN & SPRIT AB. IMPORTED BY THE HOUSE OF SEAGRAM, NEW YORK, NY. PHOTOGRAPH BY STEVE BRONSTEIN.

ENJOY OUR QUALITY RESPONSIBLY.